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GARDENS' BULLETIN

STRAITS SETTLEMENTS

Vol. X 10th January, 1939 Part 1

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1939

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Vol. X 10th January, 1939 Part 1

NOTES ON THE SYSTEMATY AND DISTRIBUTION OF MALAYAN PHANEROGAMS, I

By E. J. H. CORNER,

Botanic Gardens, Singapore

A preface to these notes is hardly necessary because, on perusal, it will become apparent that there is scarcely a genus in which some taxonomic or botanical revision is not needed. As the work is taken in hand according to the fancy or purport of the botanist, so the notes afford a means of publishing the technical results. The study of the Malayan flora has been progressing for more than a century, yet a very long time must elapse before there can be any near approach to finality. The investigation of a flora so rich and so ancient has been the concern of the merest handful of botanists, and it is a burden too great for so few lives. Add to this the difficulties of working alone in the tropics and of collecting in the vast forests, the lack of libraries and the isolation of botanists in countries floristically similar, and it is easy to understand how there has been much duplication and misunderstanding of each other's work. Now, the accumulation of specimens, the publication of "floras", the improvement in description and, not least, the facilities of modern transport and of interchange of ideas should enable one largely to overcome those obstacles, so that it is time to unify the research which has been progressing in different lands. Particularly is this important in Malaya which connects the areas explored by the British botanists in India and Siam, the French in Indo-China, the American in the Philippines and the Dutch in the Netherlands Indies. It must be realised, moreover, that much of the present disagreement and misunderstanding springs from a lack of botanical knowledge. Most

tropical plants have been described and classified from dried specimens though the true estimation of species and genera must always demand an extensive acquaintance with the living plants: what may seem diagnostic characters in dried specimens often prove to be variations among individuals or branches of the same individual when the living plant is studied. Indeed, intensive research on any of our Malayan phanerogams will reveal many misconceptions and faulty or doubtful identifications so that specific information, unsupported by specimens for reference, must be accepted with great caution. Perhaps, the falsest belief is that there is a large endemism in the islands and political divisions of the East Indies. It should be remembered that *Canangium odoratum* is a forest tree from Siam to Australia, and *Ficus variegata* from Hongkong to Java.

My own notes have arisen from an unexpected quarter. Intending to write a semi-popular book about the common trees of Malaya, I imagined that their botanical names would have been fixed. But I soon discovered that this was far from being the case. Indeed, it was not uncommon to find that what was apparently the same tree was referred to by different names by each of several different authors. Thus, when Hooker, Trimen, King, Kurz, Craib, Gagnepain, Ridley, Koorders, Valeton, Merrill, and other authors of standard systematic works concerning the flora of the Malay Peninsula and adjoining territories showed little uniformity in nomenclature, it was not surprising to find the nomenclature of such standard economic works as those of Watt, Heyne and Burkill, to say the least, unreliable. Indeed it has become evident that for too many years botanical and economic information from the Malay Peninsula and adjoining territories has been poured like new wine into old bottles, so that we cannot now be sure that our information bears the correct label. Such information may be worse than useless, and it seems time to call a halt to examine the labels on our bottles. That this is no easy task will be appreciated from perusal of the notes published in this Bulletin, but to shirk it, or to postpone it, for the sake of the more rapid publication of a semi-popular, semi-botanical work would be a grave disservice to science and to the public to whom such semi-popular work is to be addressed.

For my own satisfaction, I have adopted the principle that no alteration in botanical names should be accepted unless supported by botanical proof: by which means, only, can fact rather than opinion become the basis of argument. Taxonomically, *nomina nuda* are invalid: so, too, should be *interpretationes nudae.*

DILLENIACEÆ

Wormia and Dillenia

These genera are now often treated as one though their differences are maintained for subgenera. No one, however, has shown that there are species of intermediate character, and the sole reason for uniting them, it seems, is to facilitate the making of new species on insufficient material, because without ripe fruits it is not possible to assign a species with certainty to its genus. On the other hand, the fruit-mechanism of the two genera is very different and has a biological value readily appreciated by the naturalist. The seeds of Wormia are dispersed by birds, which take no cognisance of Dillenia-fruits, and Dillenia-seeds are dispersed by mammals or by chance, as by floating down stream. The field- botanist will like the significance of the two genera and, as I see no necessity to capitulate to the 'hortus siccus', I maintain the two in the sense of Hooker, King, Koorders, Valeton and Ridley.

Dillenia with its tendency to massive solitary flowers, connate carpels, indehiscent fruits with fleshy sepals, and deciduous habit is the more advanced. *W. Beccariana* appears to be the most primitive species.

Dillenia meliosmæfolia Hook. f. and Th., F.B.I., I, *1872*, p. 36.

= *Wormia meliosmaefolia* King, Mat. Fl. Mal. Pen. I, *1889*, p. 365.

= *Wormia parviflora* Ridley, Journ. Roy. As. Soc. Str. Br. 54, p. 6. Fl. Mal. Pen. I, p. 9.

= *Dillenia Elmeri* Merrill, Univ. Calif. Publ. Bot. 15, *1929*, p. 195.

This species was based on a collection of Griffith's from Malacca. It was transferred to Wormia by King and returned to Dillenia by Ridley who first described its indehiscent fruits and exarillate seeds. It is a Dillenia with small solitary, or paired, flowers with yellow petals and 7–10 carpels, slender very hairy pedicels and stouter peduncle (when the flowers are paired): the leaves are medium to large, narrowly oblong obovate, varying from coarsely dentate to subentire, with cuneate base, canaliculate, but not winged, hairy petiole, 12–20 pairs of side-veins which are more or less hairy beneath and excurrent in the teeth, and with rather coarse fig-like reticulation: the twigs, too, are very hairy but glabrescent when old, the hairs turning yellow in drying. As such it is an easily recognised species, well delimited from all other Malayan species, yet like these others it is decidedly variable especially in dentation of the leaf-margin and in hairiness.

W. parviflora was described by Ridley in the same paper as he transferred *W. meliosmaefolia* back to Dillenia, yet I find *W. parviflora* identical in all respects with specimens of *W. meliosmaefolia* named by King (King's Collector 4779, 5787), who was the first to expound Hooker and Thomson's species. *W. parviflora* was based on Curtis 3489 and Derry 1077, both from Malacca (the type-locality of *D. meliosmaefolia*) ; there are 5 sheets of the first and one of the second at Singapore: Curtis 3489 and Curtis 2311 had already been identified as *D. meliosmaefolia* by King. I am unable to account for Ridley's species because I can discover no difference from *D. meliosmaefolia.*

The type-collection of *D. Elmeri* is Elmer 21028 (B. N. Borneo), a specimen of which is at Singapore. It differs from the Malayan *D. meliosmaefolia* only in the glabrescent leaves and twigs and rather shortly hairy sepals. Otherwise it has all the characters of *D. meliosmaefolia,* as just noted, and no others. Nor can I discover any discrepancy in Merrill's description. I therefore reduce it but with the reservation that when more collections are known, it may prove to be a glabrescent variety such as one finds in *W. excelsa.* Forbes 1607 is just such a state from Sumatra.

Typical *D. meliosmaefolia* is known also from Sarawak, (Omar 82) and Sumatra (B. Kloss 14083, Krukoff 4047, Bartlett 6616 and 7055). It is a species of the Sunda-shelf.

Wormia Beccariana (Martelli) Ridley, Saraw. Mus. Journ. I, *1913,* p. 71.

= *Dillenia Beccariana* Martelli, Malesia III p. 158.

= *Wormia albiflos* Ridley, F.M.P. 1 p. 9.

The distinguishing features of this species are the many-flowered, pendent, zig-zag inflorescences, the white petals, the five densely hairy carpels and the petiolar wing distinct from the lamina. A type-specimen of *W. albiflos* (Ridley 11053) is in the Singapore Herbarium. I have found the species commonly in the East of Johore and collected it from Ridley's type-locality (Kota Tinggi). For the identification of these Malayan specimens with Martelli's species I have to thank Mr. C. E. C. Fischer who has compared them with specimens of Beccari's 134,497, 3076 (syntypes of *D. Beccariana*) in the Kew Herbarium. Mr. Fischer remarks that Beccari's specimens have much more pronouncedly zig-zag inflorescences and far more densely yellowish setose carpels but concludes that the differences are varietal and that the two species should be united. No other species of Wormia or Dillenia is known with these peculiar characters. That the species belongs to Wormia I have been able to ascertain from a recent collection (Kiah, S.F. No. 32016, Johore) which shows the

typical dehisced, star-like fruit; unfortunately I have not found the living fruits myself and can give no details of their colour or the nature of the aril. Ridley ascribes yellow petals to *W. Beccariana* but, surely, in error.

W. Beccariana is a plant that indicates the past connection that occurred between Malaya and Borneo. It is restricted to the East of Johore in the watersheds of the Endau, Sedili and Johore, where it is common, and to Sarawak. It certainly does not occur on the West of Malaya, which has been sufficiently well-collected in the lowlands to ensure that such a striking plant could not have been overlooked, and one can say, confidently, that it never occurred in Singapore, unlike *W. excelsa* var. *tomentella*. Why it is so limited in Malaya, I do not understand: it grows in swampy forest, lowland hillside forest and in belukar. It may occur in South Pahang, but very little is known botanically of this transitional region of Malaya.

Wormia excelsa Jack, Mal. Misc. *1822*, p. 123: haud Hook. f. & Th., Fl. Ind. *1855*, p. 67.
= *Capellia multiflora* Bl., Bijdr. *1825*, p. 5.
= *Wormia oblonga* Hook. f. & Th., loc. cit.
= *Dillenia excelsa* (Jack) Gilg, Engl. & Prantl. Pfl. vol. III, 6, *1895*, p. 123: quoad nomen, haud quoad descriptio.

W. excelsa Jack is a species described from Bencoolen in Sumatra. It seems that the type-specimen, if there ever was such, was destroyed.

Hooker and Thomson were the first to take up Jack's species but they misinterpreted it by referring to it specimens of *W. suffruticosa* (vide F.B.I. p. 35: King, Materials Fl.M.P., I, p. 8). In the same work, Hooker and Thomson described *W. oblonga* as new, and gave a description that agreed exceedingly closely with Jack's *W. excelsa*. Later (F.B.I. I, p. 35) Hooker remarked under *W. oblonga*, "Very near *W. excelsa*, Jack." King (Materials, *loc. cit*) and Ridley (F.M.P. I, p. 9) followed Hooker's interpretation of the specimens from Malaya, calling them *W. oblonga* and disregarding Jack's species.

The only difference between Jack's description of *W. excelsa* and the Malayan species, which is a fairly common tree and many specimens of which are now to hand for comparison, is that Jack gives "Peduncles ..... many flowered" and the Malayan species has only 3–6 (rarely 7) flowers on the raceme. It might be suggested that Jack would have written "few-flowered", had his specimens no more than 6 flowers, but it is clear that Jack was contrasting *W. excelsa* with *W. pulchella*, which he described immediately after, and which has solitary flowers; the expression

"many-flowered" would thus be reasonable for such a few-flowered inflorescence.

De Vriese (Pl. Reinw. *1856*, p. 79, v. VI–VII) next took up *W. excelsa* after Hooker and Thomson. His description and figure agree with *W. oblonga* and clearly do not refer to *W. suffruticosa*. But the inflorescence, as shown in the figure, has 9–13 flowers and looks more like that of *W. suffruticosa*, though the leaves are exactly like those of *W. oblonga*. I doubt the accuracy of the drawing of the inflorescence.

Miquel (Fl. Ind. Bat. I pt. 2, p. 10) added nothing of descriptive value.

Koorders and Valeton (Bijdr. I, Booms. op Java *1894*, p. 168) interpreted *W. excelsa* as a species that, from their description, is identical with *W. oblonga*: they give "racemi ..... sæpe 2–5 flori". Their interpretation has been followed by other botanists in Java; and Sumatran and Bornean specimens distributed from Buitenzorg as *W. excelsa* are identical with *W. oblonga* of Malaya.

Gilg (loc. cit) misinterpreted *W. excelsa* by placing it in the section Euwormia, which has all the stamens erect and more or less of equal length. Jack clearly stated that the inner stamens were longer than, and curved over, the outer stamens.

I conclude that the Dutch botanists should be followed in their interpretation of *W. excelsa* Jack and that *W. oblonga* should be reduced to a synonym.

As regards *Capellia multiflora* Bl., Hooker and Thomson reduced it to *W. excelsa* in their Flora Indica (*1855*) but because they also confused *W. suffruticosa* with *W. excelsa* it is impossible to decide from their work to which species Blume's should be referred. Accordingly I asked Dr. S. J. van Ooststroom, of the Rijks Herbarium at Leiden, to investigate Blume's specimens. Dr. van Ooststroom found three specimens numbered "Blume 1687" which represent the type of *C. multiflora*. They are not *W. suffruticosa* but clearly, from the drawing kindly supplied by Dr. van Ooststroom, they are *W. excelsa*. I express my indebtedness to Dr. van Ooststroom for having settled this point.

The essential diagnostic points of *W. oblonga* were all recorded by Jack for *W. excelsa* thus: "Leaves.....elliptic ovate to elliptic-oblong, acute, denticulate or obsoletely serrate.....8–12″ long. Petioles deeply channelled above .....Pedicels alternate, clavate. Flowers large, yellow, 3 inches in diameter.....Stamina.....outer ones yellow .....shorter than the inner, which are purple, erect and recurved above.....Ovaries 6–8.....capsules 6–8, whitish, semi-transparent.....Seeds.....enveloped in a red aril".

Another species of the Sunda Shelf that combines these characters of *yellow flowers, purple stamens* and *white fruits* has not been recorded.

As thus delimited I find that *W. excelsa* is a variable plant. While the flowers, inflorescences and fruits retain their constant characters, the leaf-blade varies from elliptic with rather suddenly narrowed base to oblong obovate with narrowly cuneate base, and in texture from thin to distinctly coriaceous: the leaf edge varies from almost serrate to very finely denticulate with minute shrivelled points scarcely visible to the naked eye, and even entire: the leaves and twigs may be glabrous or sparsely puberulous or distinctly adpressedly hairy on the petioles and undersides of the main veins as on the twigs: the sepals are generally villous, but may be sparsely puberulous and even glabrous.

The typical state of *W. excelsa,* in the taxonomical sense, I take to be that with rapidly glabrescent leaves, twigs, inflorescences and sepals so that the mature parts are glabrous. Jack made no mention of hairiness in his description of *W. excelsa,* nor in that of *W. pulchella,* which is invariably glabrous; and, as Jack was always careful to note matters of hairiness in his excellent descriptions, one may safely conclude that his specimens were glabrous: had they had the hairy sepals or leaves of the two varieties, which I propose, he could not have failed to have noticed them. Further, neither de Vriese, nor 'Koorders & Valeton' indicate hairiness of sepals; of the leaves they write glabrous; and I think that they would not have omitted such points, had they been present in their specimens.

From this basis I make the following classification, but not without the reservation that there are intermediate states connecting the varieties and the typical state.

W. excelsa Jack

Twigs, petioles, leaves, inflorescences and sepals sparsely adpressedly hairy when young, soon glabrous or glabrous from the first: leaf-blade more or less distinctly toothed to almost or quite entire.

MALAYA: Johore, For. Dept. 12061; Corner 29335; Corner s.n. 27.7.32.
SUMATRA: Herb. Hort. Bot. Bog. bb. 17484; bb. no. E. 981, bb. no. 201E Bartlett 6597.
BORNEO: Elmer 20051 (B.N.B.).

Elmer 21159 (B.N. Borneo) may be placed here as it has the leaves of *W. excelsa* and glabrous inflorescences and sepals, but the young twigs are as hairy as in the next variety: it is an intermediate state.

var. **pubescens** var. nov.
= *W. oblonga* Hook. fil. et Th.

Pedunculis, pedicellis et sepalis adpresse sericeo-hirsutis: *sepalis saepe subtomentosis:* pilis siccis fulvis: laminis dentatis vel denticulatis raro subintegris.

MALAYA:—
KEDAH, Ridley 5370;
PENANG, Curtis 257;
PROVINCE WELLESLEY, For. Guard 12625;
PERAK, Curtis 3184, Wray 735, Derry C. 257, Corner 31510, Ridley 14083;
SELANGOR, Strugnell 13955, Ridley 13388, Hamid C. F. 602, Goodenough 10623, Hume 8322;
NEGRI SEMBILAN, C.F. 0588, 1984;
MALACCA, Alvins 353, Goodenough 2005, Derry 1025 and 46;
PAHANG, Ridley 2625, 2637, Walker 14153, Hamid C.F. 5166, Kalong 20469, Burkill 16856.
SUMATRA: Posthumus 1025.
BORNEO: Boden Kloss 19089: For. Dept. B.N.B. 4565.

This is the commonest state of the species in Malaya. Both Hooker and King described hairy sepals for *W. oblonga.*

var. **tomentella** var. nov.

= *D. tomentella* Martelli, Malesia III, p. 159.
= *W. tomentella* (Martelli) Ridley, F.M. Pen. 1, p. 10.

Ramulis, petiolis, foliisque (pagine inferiore) *pilosotomentellis,* vix glabrescentibus: folii margine integro vel vix denticulato: pedunculis pedicellisque mox tomentellis, mox glabrescentibus: *sepalis glabris vel sparse puberulis.*

MALAYA:—
SINGAPORE, Ridley, 6382, 6809: s.n. Bandstand 1890 and 1892. C.F. Baker s.n. 15.10.17: Md. Nur 1473, 1892: s.n. 3.9.18: s.n. 18.6.24: Symington 22979.
JOHORE, Kiah 32190.
BORNEO: Herb. Hort. Bot. Bog. bb. 16232: Haviland 1989: Carroll 7170.

The Malayan specimens referred by Ridley to *W. tomentella* Mart. are to me no more than a variety of *W. excelsa,* having hairy twigs and leaves, generally entire edges to the leaves and glabrous sepals. They have the same characteristic inflorescence, purple anthers and white fruits. I have compared dried and spirit-material of flowers and fruits of both species and can find no structural difference. Although the leaf-edge in this variety is generally entire, in Baker's collection it is distinctly denticulate and in several collections of *W. excelsa* and *W. excelsa pubescens* the edge is very finely denticulate and even entire, *e.g.* Ridley 5370 and 13388, Curtis 257, Derry 6257, Herb. Hort. Bot. Bog. bb. 16174. The hairiness of the vegetative parts varies considerably and it is by no means possible to distinguish this variety from typical *W. excelsa* absolutely.

It is curious that var. *tomentella* should have hairy vegetative parts and glabrous sepals, while var. *pubescens* should have glabrous vegetative parts and hairy sepals.

For the identification of these Malayan and Bornean specimens with *D. tomentella* Martelli, I have to thank Mr. C. E. C. Fischer, of Kew Herbarium, who has compared the Malayan specimens with Beccari 1193, which is a syntype of Martelli's species. Martelli described the number of carpels as 10 which Mr. Fischer corroborates, whereas they are 5–9, mostly 6–7, in my var. *tomentella:* but, as Mr. Fischer remarks, if they vary so much they may quite well go on to 10. I am inclined to think that var. *tomentella* is truly confined to W. Borneo and S. E. Malaya. It is frequent in the Reservoir Jungle in Singapore and in the watershed of the Sedili in the East of Johore. Several plants have this limited distribution e.g. *W. Beccariana, Pandanus epiphyticus.*

W. suffruticosa Griff.

Ic. Plant. Asiat. Pl. IV, *1854,* pl. 649.

Ridley, Journ. R. As. Soc. Str. Br. 54, *1909,* p. 5: Fl. Mal. Pen. I. p. 7.

Syn. *W. subsessilis* Miq., Fl. Ind. Bat. Suppl. I, *1860,* p. 619 (fide King in Mat. Fl. Mal. Pen. I, p. 8). Ridley loc. cit. (1909) p. 4.

W. subsessilis var. *borneensis* Ridley, Journ. R. As. Soc. Str. Br. loc. cit.

W. suffruticosa var. *borneensis* Ridley, Sarawak Mus. Journ. I, *1913,* p. 71.

Ridley has endeavoured to distinguish *W. subsessilis* from *W. suffruticosa,* while other authors follow King and unite them. In order to decide the point, I have made a special study of the species in Singapore and in South Johore, having made expeditions to the Sedili River in Johore purposely to compare living specimens side by side.

Ridley distinguishes *W. subsessilis* by its nearly or quite glabrous young parts, by its stouter habit and larger size, by its faculty of rooting from the branches and thus of forming thickets, by its less dentate leaves with narrower base and more slender, glabrous racemes. Such a state one can distinguish from typical *W. suffruticosa* which has the young parts and racemes adpressedly white floccose and which is often a rather slender shrub. However, I have seen on the Sedili River as many plants that are intermediate in all degrees as there are typical ones and some that show different variations not remarked by Ridley. The shape, colour, size and structure of the buds, flowers, fruits and seeds are identical in all these states, forms or varieties, and therefore I have no hesitation in following King in his

reduction of *W. subsessilis*. *W. suffruticosa* thus becomes a well-characterised species of Sumatra, Malaya and Borneo, with vaginate petiole confluent with the large coarsely toothed blade, large flowers with yellow petals, cream white stamens and pink fruit, and, in habit, it is an evergreen, sprawling, dense shrub that will root from the decumbent branches. It is not a tree.

As regards the hairiness, which seems the chief distinction between *W. subsessilis* and *W. suffruticosa*, I may say that it is not difficult to find a few twigs with slightly silky young leaves and racemes on plants which are for the most part glabrous, and that plants with all the young twigs and racemes thinly floccose, so that one cannot decide to which species they should be referred, are frequent on the Sedili River. On the same plant the leaves vary in toothing and exact outline, the vigorous vegetative shoots having larger and more coarsely toothed leaves than the flowering shoots, and saplings having larger leaves still. As regards a distinction in habit, I can find no support for Ridley's statements. By the Sedili River, both glabrous and floccose forms make thickets that spread by rooting from decumbent branches.

As regards the racemes I find that some plants have simple racemes of 4–9 flowers on a flowerless peduncle 3–6″ long, that other plants have racemes with 2–5 branches, each with 3–8 flowers, on a common peduncle 6–10″ long and that on other plants one can find branched and simple racemes with peduncles of intermediate length, *e.g.* S.F. No. 32984. Moreover, one can find both glabrous plants with simple or branched racemes and floccose plants with simple or branched racemes, so that if one regards the hairiness and the branching of the raceme as characters of varietal rank one must make four varieties to cover the combinations of the two characters. Even so, many plants will be found that are intermediate between the varieties. An intensive and extensive study of the species will reveal, no doubt, a dozen possible varieties to name which seems purposeless.

Ridley has made a variety *borneensis* of *W. subsessilis*, from "Borneo, Sarawak: in swamps at Kuching abundant". He later transferred the variety to *W. suffruticosa*. There is no exact typification but in the Singapore Herbarium there are two sheets which must undoubtedly have been the basis of Ridley's variety. Their labels are written in his hand. The collections are:—

(*a*) "Kuching July 1899 nr. *suffruticosa* but flrs. much larger, fruit white".

This sheet consists of a large glabrous leaf without petiole and some flower buds.

(*b*) "J. Hewitt, Kuching 1909. *Wormia suffruticosa* var. *borneensis*".

This sheet consists of two twigs each with a leaf and flowering racemes, and some flower buds in a packet.

Sheet (*b*) has adpressedly floccose young leaves, twigs and racemes and coarsely dentate leaves, as stated in Ridley's description of var. *borneensis*. It is identical with *W. suffruticosa* in Malaya. As for the flower size, Ridley says (loc. cit. p. 3) the flowers of var. *borneensis* are bigger than those of *W. subsessilis* and *W. suffruticosa* but, on pp. 4 and 5, he gives the flowers of *W. subsessilis* as 5″ wide and those of var. *borneensis* as "4″ across or more". The normal variation in *W. suffruticosa* I find to be 4–5″, and the flowers and buds on the sheets (*a*) and (*b*) are the same size as those of *W. suffruticosa* when dried.

As regards the colour of the fruit of var. *borneensis*, which is described as white, there is only the evidence of the note on the field label of sheet (*a*). Who made the note? May not the whiteness refer to the white edges of the dehisced carpels, or to an old bleached fruit? I consider var. *borneensis* a myth.

ANNONACEÆ

Anaxagorea

A. Scortechinii King

Mat. Fl. Mal. Pen. No. 4, vol. I, *1892*, p. 69.
Ann. Roy. Bot. Gard. Calc. IV, *1893*, p. 85, pl. 119.

There can be no doubt that this species is *A. javanica* Bl. Boerlage suggested its identity in 1889 (Ic. Bog. vol. I, 2nd fasc., p. 110). I find that *A. Scortechinii* in Malaya is variable in a manner not yet described. Apart from differences in leaf-size, which are considerable, the number of flowers on the inflorescence (1–several) and the size of the fruit, some specimens have six petals, others three, and others two. Those with six petals have the inner three considerably smaller than the outer three, as Blume described and figured for *A. javanica*. Those with three petals have only the outer row, the inner being absent. Those with two petals have no inner row of petals and they have only two sepals. In leaf, flower-shape, colour, structure and size, and in fruit-characters, these three states are identical. It is nevertheless desirable to distinguish two as varieties (*tripetala* and *dipetala*) from the hexapetalous type.

The distinguishing marks of the species are the rather broad, many-veined leaves, the inflorescences on the leafy twigs, the thick, fleshy petals, the circle of sterile stamens

round the carpels which they overtop with outcurved ends, and the numerous carpels of which 4–10 develop into fruits.

The diagnostic specimens from Malaya are as follows:—

A. javanica Bl. Fl. Jav. Anon. (*1828*), p. 66, t. 32 and 36A.
Six petals in two whorls.
KEDAH: Curtis 2644;
KELANTAN: Henderson 29534 (det. *A. ?luzonensis*): Nur 11954;
TRENGGANU: Corner 30215;
PAHANG: Henderson 10656, 22483: Holttum 20529 (all det. *A. luzonensis*);
SINGAPORE: Botanic Gardens, s.n. (several collections).

Curtis 2644 was named *A. Scortechinii* by King though it has six petals. King evidently overlooked this point.

A. javanica var. **tripetala** var. nov.:
= *A. Scortechinii* King loc. cit.
petalis interioribus deficientibus.
PERAK: Henderson 23788 (*Type-collection:* type-specimen in Herb. Singapore): Haniff & Nur 6951: Ridley 14734: Wray 3400.
SELANGOR: Hume 8390.
BORNEO: Elmer 21131 (Tawao, B.N.B.).

King did not indicate a type, or a numbered collection, for *A. Scortechinii*. Presumably the type would be Scortechini's collection, no specimen of which is at Singapore. I am therefore obliged to define anew this tripetalous entity.

A. javanica var. **dipetala** var. nov.
sepalis 2: petalis 2, interioribus deficientibus.
JOHORE: Corner 28972 (*Type-collection:* type specimen in Herb. Singapore): 29464: s.n. 9.2.35: s.n. May, 1935.

These four collections come from two tributaries (*S.* Berassau and S. Kayu Ara) of the Sedili River (S. Sedili) in the East of Johore. The variety is common there, but I have not found either of the other states with it. The collection, s.n. May 1935, has very large fruits, the follicles being 4.8 cm. long, 1.2 cm. wide at the apex, and the seeds measuring 1.7 cm. long. Whether such big fruits are also distinctive of the variety, I do not know.

A. luzonensis A. Gray

There is no reliable evidence that this species occurs in Malaya. The simple diagnosis of 6 petals for *A. luzonensis* and 3 for *A. Scortechinii*, given by King, does not hold and has led to the wrong identification of several Malayan collections.

A. luzonensis differs from *A. javanica* in having thinner, subequal petals, a much more open flower, no

sterile stamens round the carpels, only 1–3 carpels (rarely 4) of which only 1–2 set fruit, and a spike-like style at the end of the follicle, as well as in the smaller leaves (apparently not exceeding 6.5 cm. wide) with fewer pairs of side-veins (6–8: in *A. javanica* 8–12).

Goniothalamus

G. malayanus Hook.f.et Th. and **G. Tapis** Miq.

The only difference that I can find between these two species, as the names have been applied to the Malayan specimens by King and Ridley, is that *G. Tapis* has round or ovoid, 1-seeded fruiting carpels whereas *G. malayanus* has larger, oblong 2–3 seeded fruiting carpels. I believe, however, that there may be differences in the size, colour and shape of the petals, but these points cannot be made out with certainty, if at all, from dried specimens of 'open-budded Anonaceæ' because it is impossible to decide whether the flower is really full grown. The leaves are variable in size, shape and texture regardless of the characters of the fruit. A study of living specimens will be needed to determine their specificity.

Canangium

C. odoratum (Lam.) Baill.

This species appears to be very widely distributed in the wild state. It is said to be indigenous in Burma, Java, the Moluccas and the Philippines. Ridley says that it is not wild in the Malay Peninsula (F.M.P. I, p. 43), but this is a mistake, as I will presently show. In the Singapore Herbarium there is a specimen from Celebes, evidently from a wild tree, and another from the rain-forest of North Queensland (Brass No. 2258). I have no doubt that it is wild throughout the range of the lowland rain forest from N.E. India to New Guinea and N. Australia. *C. odoratum* is thus a species the distribution of which defines what is undoubtedly the extent of the flora of the Malay Archipelago in its fullest sense. It is such far-flung and easily distributed plants that one should take to indicate the major regions of Plant Geography.

The 'Kenanga utan' of Malaya is the wild form of the species in the Malay Peninsula. It is very common in secondary jungle, at the edge of the forest and by stream and river-banks in the forest from Negri Sembilan northward to Kedah and Kelantan. It differs from the cultivated Kenanga in having rather rank-smelling flowers and, apparently, smaller fruiting carpels containing fewer seeds

and more numerous carpels to the flower. In habit it is also more upright with less drooping branches but such features are probably caused by its growth in the jungle. In leaf, flower, bark, and fruit- and seed-structure, the wild and cultivation forms are identical. I have compared living and preserved material side by side. How Ridley overlooked the 'Kenanga utan', I do not understand. If it is regarded as an 'escape' in Malaya, then it is very remarkable *1.* that there should be hundreds of wild trees at the edge of the forest by the railway from Kuala Lipis to Kuala Krai, where there is scarcely a cultivated tree; *2.* that it should be absent from the south of the Peninsula where there are plenty of cultivated trees. Moreover, if one cannot accept the present occurrence of the 'Kenanga utan' in Malaya as that of a wild plant, it will surely be impossible to prove its wild status in any country.

C. Scortechinii King, Mat. Flor. Mal. Pen. I, *1892*, p. 291.
Type Collection:—Scortechini, Perak.

A sheet of the type-collection is in the Singapore Herbarium. The specimen has only small, half grown leaves near the ends of the twigs and a few, very young flower-buds. I have no doubt that all the mature leaves and full-grown flowers fell off in the press, as generally happens with the Kenanga unless it is dried very rapidly on the day of collecting. I can see no difference from similarly prepared specimens of Kenanga and therefore I reduce *C. Scortechinii* to *C. odoratum.*

King says that *C. Scortechinii* differs from *C. odoratum* in having smaller leaves, a different inflorescence, with smaller, quite inodorous flowers. It is also a smaller tree. King gives the leaves as 2.5″ long but quotes Scortechini as giving them 3–7″ long (as I have just suggested, the old leaves probably fell off in the press). Concerning the inflorescence I can discover no difference from *C. odoratum* either in the specimen or in King's descriptions. The flowers on the specimen are smaller than those of *C. odoratum* because they are very young, which King also notes: for this reason also they have short pedicles. In distinguishing *C. Scortechinii,* neither King nor Ridley seem to have been aware of the fact that the flower-buds of *C. odoratum* open long before the flowers are full grown, when the petals are no longer than the sepals and the pedicels are still short: as the flower grows, so petals and pedicel lengthen until the flower turns yellow, ripens and becomes fragrant. That the flowers of the type of *C. Scortechinii* were immature is shown by King's remark on their absence of smell, which doubtless was taken from Scortechini's field notes. The size of the tree is no

indication of specificity. The cultivated Kenanga may begin to flower when 8 ft. in height and subsequently grow to 80 ft.

I conclude that *C. Scortechinii* was based on imperfect specimens of *C. odoratum* with immature flowers.

C. fruticosum Craib, Kew Bull. *1922*, p. 166.

"*C. odorato* (Hook. f. et Thoms.), simile sed habitu humiliore, foliis basi sæpissime cuneatis, pedicellis longioribus differt".

From the description there is no specific difference between *C. fruticosum* and *C. odoratum*. The habit of "frutex 3–4–metralis" for *C. fruticosum* suggests the dwarf variety of *C. odoratum* which is cultivated in Malaya. This dwarf-variety is a shrub reaching 6 ft. high that flowers throughout the year, often has supernumerary petals ('petala sæpissime 6, rarias 8. . .', *C. fruticosum*) and never sets fruit (fruits not mentioned for *C. fruticosum*). The shape of the leaf-base varies greatly in *C. odoratum*, even on the same tree, from cuneate to cordate. The length of the pedicels in *C. odoratum* varies according to the age of the flower and the position of the flower on the twig and the inflorescence: the uppermost flowers on the inflorescence often have shorter pedicels than the lower in which they may reach 8 cm. long (only "usque ad 5 cm" for *C. fruticosum!*), and the inflorescences from the upper leaf-axils on a twig often have more shortly-stalked flowers. I do not find that Craib, either, has considered the peculiar development of Annonaceous flowers.

As it is convenient to have a botanical name for this dwarf Kenanga, I reduce *C. fruticosum* Craib to a variety of *C. odoratum*, namely *C. odoratum* (Lam.) Baill. var. **fruticosum** var. nov.

CAPPARIDACEÆ

Cratæva

I have had great difficulty in identifying the Malayan species. It seems that most of the Asiatic and Polynesian species are very imperfectly known. King has credited the Malayan flora with *C. macrocarpa* Kurz and *C. hygrophila* Kurz (Mat. Fl. Mal. Pen. I, *1889*, p. 42). Ridley has given *C. macrocarpa* Kurz and *C. religiosa* Forst. (Fl. Mal. Pen. I, *1922*, p. 125). Craib has given *C. macrocarpa*, *C. hygrophila* and *C. Nurvala* Ham. (Fl. Siam Enum. I, *1925*, p. 85). And, most recently, Burkill has given *C. macrocarpa* and *C. Nurvala* (Dict. Ec. Prod., *1935*, p. 676). According to the key and diagnoses of Kurz (Journ. Bot. *1874*, p. 194) and the descriptions of Gagnepain's which are the most

recent that I can find (Fl. Gen. Indoch. I, *1908*, p. 177), the wild Malayan specimens in the Singapore Herbarium belong to *C. macrocarpa* and *C. lophosperma* Kurz. That *C. religiosa* (of India), *C. Nurvala* or *C. hygrophila* is wild in Malaya, there is yet no evidence. *C. Roxburghii*, however, has been introduced to Malacca.

The important points to note in Cratæva are the shape, venation and stalk of the leaflets, the number of stamens and whether they are united or not, the shape and structure of the ovary (1– or 2–celled), the shape of the fruit and the size, colour and surface-markings of the seed: perhaps, too, the colour of the petals and the density of the inflorescence.

Our two wild Malayan species, which for argument I will call A and B, are distinguished this way:—

Cratæva A (*C. lophosperma*)

Leaflets 6–20 × 2.5–7.5 cm., lanceolate to ovate-elliptic, apex attenuate-acuminate, subcoriaceous, subglaucous beneath, distinctly and closely reticulate on both surfaces of the dried leaf: *primary lateral veins* 13–19 pairs, crowded: *petiolules* 3–9 mm. long, distinct: *petals* white then cream buff: *stamens* 24, or as few as 18, the others being more or less abortive, not joined at the base: *ovary* oblong elliptic or subcylindric, clearly 2-celled through the meeting of the 2 marginal placentas along the axis, their broad ends closely apposed: *fruit* 4–5 × 3–4.5 cm., broadly elliptic: *seeds* 11–13 mm. wide, deeply reniform, dark grey brown to cinereous blackish (herb. spec.), verrucose along the rather narrow, 1–3 mm. wide, often crested, outer convex border: *habitat*, stream banks and open woods on sandy soil, in the north-eastern part of Malaya.

Cratæva B (*C. macrocarpa*)

Like *Crataeva A* but:—

Leaflets 9–27 × 4–11 cm. relatively broader, *ovate elliptic, membranous* though becoming ± coriaceous in fruiting plants, not glaucous, reticulations wide and generally faint on both surfaces: *primary lateral veins* 7–10 pairs, *fewer, widely-spaced: petiolules* 0–2 mm. long, *the leaflets generally sessile: stamens* 10–16, *fewer,* often slightly joined at the base: *fruit* rather larger, 6–7 × 5–5.5 cm.: *seeds light brown* (herb. spec.) with a rather broad, 3–5 mm. wide, densely verruculose, convex outer border: *habitat* in very swampy ground, in the middle and south of Malaya.

As regards *Crataeva B*, according to the key and descriptions of Kurz, it should be *Crataeva macrocarpa* except that Kurz has attributed a 1–celled ovary to his

species. The specimen of *Crataeva B*, Wray 3348 (Perak), King has identified with *C. macrocarpa*, presumably by comparison with Kurz's type (Maingay 125, Malacca). King described the ovary of *C. macrocarpa* as having 2 parietal placentas and he corrected Kurz's description of the seeds as smooth (unripe) to "shortly tuberculate along the edge". According to Gagnepain's key, *Crataeva B* is also *C. macrocarpa* but Gagnepain has described it with 20 stamens. Both Kurz and King emphasized the fact that *C. macrocarpa* had no more than 15 stamens. There are later collections of *Crataeva B* from Malacca, the 'type-locality' at Singapore, but none of *Crataeva A*. I am convinced, therefore, that *Crataeva B* is *C. macrocarpa*, however the name has been misunderstood.

As for *Crataeva A*, it cannot be identified in Kurz's key unless one allows the fruit of *C. lophosperma* to vary from globose to ellipsoid, in which case *Crataeva A* agrees exactly with *C. lophosperma*. (Kurz described the 2-celled fruit). This is also Gagnepain's interpretation of *C. lophosperma*. I therefore identify *Crataeva A* with *C. lophosperma*.

Most of the specimens identified with *C. macrocarpa* in the Singapore herbarium are *C. lophosperma*. The two species have been confused by Ridley and Burkill. As the flowers of *C. lophosperma* have never been described, and I was fortunate enough to find a tree in flower at Tumpat in Kelantan, during April 1937, (S.F. No. 33444), I can give the following description:—

Inflorescence: a large, rather dense, erect, many-flowered, corymbose raceme, reaching 30 cm. long, 26 cm. wide across the open flowers: *bracts* lanceolate, caducous, 3–4 mm. long, green: *peduncles* 2.5–6.5 cm. long green: *sepals* 2–3 mm. long, ovate, acute or subacuminate, tiny, green: petals 3 cm. long, 1.5–2.0 cm. wide, the stalk 4–6 mm. long, ovate, subacute, the upper two slightly larger than the lower two, white then cream-buff: *stamens* 18–24, nearly or quite as long as the gynophore, not joined at the base, the filaments purplish, the anthers 2.5 mm. long and brownish with deep orange pollen: *gynophore* 6.5–8 cm. long, purplish: *ovary* 4.5 × 2.5 mm., subcylindrical, slightly constricted at top and bottom, green, capped with the convex, entire, minutely papillate stigma, internally completely divided into 2 cavities by the meeting of the blunt edges of the 2 parietal placentas along the axis of the ovary, the placentas not coalescent: *receptacle* 9 mm. wide, with a tumid, arcuate, transversely rugose, green ridge between each sepal, making an arcuato-quadrate torus: flowers not or scarcely fragrant.

The questions now arise whether *C. Nurvala* is *C. lophosperma* and whether *C. macrocarpa* is *C. membranifolia* Miq. Taking *C. Nurvala* first, according to Kurz and Gagnepain it has ellipsoid, 2-celled fruits, like *C. lophosperma,* but small smooth seeds 5–6 mm. wide. That it is very similar to *C. lophosperma,* Gagnepain has admitted and such is evident also from Rheede's description and figure of Niirvala (Hort. Malab. III, t. 42): Rheede, however, described the flowers of Niirvala as white, the fruits as "intus quadripartita" and the seeds as "flavescentia". I do not think that one can overcome the discrepancy about the seeds by supposing that only immature seeds of *C. Nurvala* have been described, though it is impossible to say how far the several descriptions of *C. Nurvala* are severally original or copied. Gagnepain has placed *C. Nurvala* and *C. Roxburghii* as varieties of *C. religiosa,* but according to Alston *C. Roxburghii* has dull orange petals (Handb. Fl. Ceyl. Suppl., *1931, p.* 13): and small smooth, black seeds and a unilocular ovary are attributed to *C. Roxburghii* by Kurz, Gagnepain, Trimen (Fl. Ceyl. I, p. 59) and Hooker (Ic. Pl. II, t. 178) (*see* below). It seems therefore that there are 3 distinct species *C. Roxburghii, C. Nurvala* and *C. lophosperma,* the index to which is at present by their seeds. Hence, one may confidently say that *C. Nurvala* described by Koorders and Valeton with large tuberculate seeds must be *C. lophosperma* (Bijdr. Booms. Java IV, p. 266).

Concerning *C. membranifolia* nothing more has been published than Miquel's description (Fl. Ind. Bat. Suppl. I., *1860–62,* p. 387) and King's hazard that it might be *C. macrocarpa.* From Miquel's words "Foliola brevissime petiolulata.....membranacea, basi.....quasi decurrente, lateralia ovato-elliptica.....stamina 15?, plurave?" King's suggestion appears very probable. Gagnepain attributes coriaceous leaves to *C. macrocarpa* but I think that the young membranous foliage with the flowers becomes coriaceous as the fruit sets.

Concerning the occurrence of *C. Roxburghii* in Malaya, there are two sheets in the Singapore Herbarium which appear to be referable to the species, namely Ridley 3314 (Tanjong Kling, Malacca) and Holttum s.n. 20.8.32 (Residency Garden, Malacca). They represent a species abundantly distinct from the two foregoing in the smaller size of all the parts, excepting the sepals and anthers, the round fruit, the unilocular ovary and the smooth seeds. The following are the details of this species:—

Petioles 3–10 cm. long: *leaflets* 4–9 × 2–4.5 cm., ovate, tapered to a long point, membranous, (? not glaucous

beneath): *primary lateral veins* 5–8 pairs: *petiolules* 3–9 mm. long, very distinct: *racemes* up to 8 cm. long: *peduncles* up to 4–5 cm. long: *sepals* 3–4 mm. long, ovate lanceolate, with a fine tapered point, green: *petals* about 1.8 cm. long, greenish white, then cream and finally yellow: *stamens* about 24, as long as the gynophore, violet pink, the anthers 3 mm. long: *gynophore* 2.5–3.5 cm. long: *ovary* 2.5 mm. long, subglobose, 1-locular with 2 short parietal placentas (not nearly meeting each other): *fruit* 2 cm. wide, globose, almost smooth: *seeds* 4–5 cm. wide, deeply reniform, smooth, black.

According to Kurz's and Gagnepain's keys, it must be *C. Roxburghii.* It agrees very well with Gagnepain's description except that the leaflets appear not to be glaucous beneath and they are not very distinctly reticulately-veined. It agrees also well with Hooker's plate of *C. Roxburghii* cited by Kurz though Hooker gives only 16–20 stamens, the sepals much more ovate and the ovary ellipsoid, (Ic. Pl. II, t. 178). Trimen, however, described a plant with larger flowers as *C. Roxburghii* from Ceylon, and to this plant Alston added "petals dull orange". Nevertheless, I refer these two specimens from Malacca to *C. Roxburghii* with the reservation that *C. Roxburghii* is variable and in need of much more accurate description than it has received. The Malacca plants have certainly been introduced to Malaya because they have not been found elsewhere in the country and Malacca has been a focus of commerce from India for many centuries. *C. Roxburghii* can be mistaken at first sight for *C. macrocarpa* but the stalked leaflets will distinguish it.

Now, in spite of the very imperfect knowledge of the differences between what seem to be some half dozen undoubtedly good species in Continental Asia, Merrill has recently identified with confidence Loureiro's two species of Capparis, *C. falcata* and *C. magna*, with *C. Nurvala* and *C. macrocarpa* respectively (Trans. Am. Phil. Soc. XXIV, pt. II, *1935*, p. 172). After scrutinising Loureiro's descriptions, I have come to the conclusion that these two species of his cannot be identified with certainty, until all the Asiatic members of the genus have been critically revised and their distribution is better known, and that with the present knowledge *C. magna* is probably *C. lophosperma* and *C. falcata* is altogether doubtful. Indeed, Merrill has given no reason why he should select *C. Nurvala* and *C. macrocarpa* for identification with Loureiro's out of the five possibilities of Indo-Chinese plants (3 species, 2 varieties) given by Gagnepain and the 7 possibilities given by Kurz.

My reasons for rejecting Merrill's interpretations are as follows:—

Cratæva falcata (Lour.) D.C.

identified with *C. Nurvala* Ham. and *C. religiosa* var. *Nurvala* Hook. by E. D. Merrill.

In the first place *C. falcata* may very well be *C. religiosa* as that name has been applied in India (Hooker, Beddome, Brandis). No one has yet stated what are the differences between the Asiatic specimens and the original Polynesian specimens of *C. religiosa.* Craib remarked that they were quite different but gave no reasons and he is merely quoted by Merrill as stating such. What is *C. religiosa typica* of India?

In the second place, only Loureiro's description of the fruit as oblong prevents *C. falcata* from being *C. Roxburghii.*

In the third place, what is *C. Nurvala?* Kurz was the first to interpret it and he referred to it a plant with *bilocular* ovary from N. E. India and Burma, as well as Rheede's Niirvala the fruit of which was described as "intus quadripartita". Loureiro described his *C. falcata* as "Bacca ....1–locularis". *C. Nurvala,* as interpreted by Koorders and Valeton is *C. lophosperma,* as I have just shown, which cannot be *C. falcata* on account of its warted seeds, unless one supposes *C. falcata* to have been described from immature seeds.

In the fourth place, Gagnepain has suggested that *C. falcata* might be *C. erythrocarpa.* Merrill has not refuted this possibility.

In the fifth place, the description of *C. unilocularis* Ham. ex Don reads just like that of *C. falcata.* But what is *C. unilocularis,* for Kurz's interpretation reads rather differently from Don's?

In the sixth place, Squires 210 from Hue (Loureiro's place of residence), identified by Merrill with *Crataeva religiosa* and *Capparis falcata,* is *C. lophosperma.*

Cratæva magna (Lour.) DC.

identified with *Crataeva macrocarpa* Kurz by E. D. Merrill.

What is meant by *C. macrocarpa,* Merrill has not explained. It is important that this should have been done because, as I have just shown, *C. macrocarpa,* which is based on a Malaccan specimen, has been consistently mistaken by Malayan botanists of this century for *C. lophosperma.* Merrill himself has misidentified Squires 210 and 854, which are *C. lophosperma.* The important points in Loureiro's description are "Foliis lanceolatis.....Filamenta 24.....

Bacca subrotunda.....1–locularis.....seminibus....cortice punctato, aspero, cinereo-viridi".

As I have just shown, *C. macrocarpa* has ovate leaflets, not more than 16 stamens, a bilocular ovary, broadly ellipsoid fruit and pale brown seeds. If *C. magna* were *C. macrocarpa,* Loureiro made the unlikely omission of the membranous and sessile character of its leaflets besides miscounting the stamens, on which point he was accurate *e.g.* Rhizophora. On the other hand, *C. lophosperma* has lanceolate leaflets (at least on the flowering twigs), 24 stamens, and cinereous seeds, though its ovary is 2–locular and its fruit ellipsoid. According to Kurz's key, *C. magna* would be *C. tumulorum* Miq. How then can one agree with Merrill's conclusion that "there is no longer even reasonable doubt as to the identity of *Capparis magna* Lour. with *Crataeva macrocarpa* Kurz"?

Specimens Examined

Crataeva lophosperma Kurz.
INDO-CHINA: Squires 210 (det. *C. religiosa*), 854 (det. *C. macrocarpa*).
SIAM: Forest Dept. F.M.S. 3858 (det. *C. macrocarpa*).
MALAYA: Corner 33444: Haniff & Nur 10194 (det. *C. macrocarpa*): Henderson 19624, 29613 (det. *C. macrocarpa*): Holttum 15226 (det. *C. macrocarpa*): Hose 34 (det. *C. macrocarpa* and *C. hygrophila*): Lambak 3167 (det. *C. macrocarpa*): Ridley 5046, 14667, 15205, s.n. River Tahan 1891 (det. *C. macrocarpa*): Seimund 54 (det. *C. macrocarpa*), 948 (det. *C. religiosa*).
BORNEO: Winkler 2742 (S.O. Borneo), indet.
Crataeva macrocarpa Kurz.
MALAYA: Alvins 534; Corner s.n. Johore 1932: Fielding s.n. Malacca 1892: Fox s.n. Pahang 1893: Goodenough 31 (det. *C. religiosa*), 1709, 1779 (det. *C. Roxburghii*): Haviland s.n. Pahang 1890 (det. *C. religiosa*): Jaamat 16508 (det. *C. religiosa*): Ridley 7630: Wray 3348: Yeop 3175.
BORNEO: Haviland 2832 (Rejang), indet.
Crataeva Roxburghii R. Br.
MALAYA: Ridley 3314: Holttum s.n. 20.8.32 (Residency, Malacca).

HYPERICACEÆ

Cratoxylon

Before the fundamental taxonomy of the genus can be settled, Blume's species and identifications must be studied but, particularly, the early species *Hypericum cochinchinense* Loureiro (*1790*), *Elodea sumatrana* Jack (*1822*) and *Elodea formosa* Jack (*1822*), referred to Cratoxylon and Tridesmis by Blume, must be recognised. There are no type-specimens of these three. They were described from living plants, as shown by the colour-notes

of flower and leaf, and they were given a definite country of origin. The descriptions of Jack's species from Sumatra are so detailed that their identification should be easy when the flora of that country is better known. Loureiro's description leaves much to be desired: nevertheless I think one can prove fairly to what it must have referred.

In his commentary on Loureiro's Flora (Trans. Am. Phil. Soc. 24, pt. II, *1935,* p. 268) Merrill has sought to instate Loureiro's species, as *C. cochinchinense* (Lour.) Bl., for *C. formosum* (Jack) Dyer (=*E. formosa* Jack), following the suggestion of Pierre's (Fl. For. Cochinch. *1879–1899*). Merrill's identification has been taken up by Burkill (Dict. Ec. Prod. Malaya *1935*) and is likely to become current. I will show now that it is untenable and, likewise, the reference of the plants described by Loureiro as *Hypericum olympicum* Linn. and *H. petiolatum* Linn. to *Cratoxylum ligustrinum.* I wish to show also that *E. formosa* Jack is misunderstood and that *E. sumatrana* Jack is unidentified.

Firstly I will state under their customary names the diagnostic characters of living plants of five out of the six species of Cratoxylon which must be taken into account. For the sixth, *C. racemosum* Bl., I have borrowed from the description of Koorders' and Valeton's (Bijdr. 5, Booms. op Java, *1900,* 135). I use inches to facilitate reference to the early descriptions.

C. arborescens (Vahl) Bl., Mus. Bot. Lugd. Bat. II, *1852,* p. 17.

A medium-sized to lofty, *evergreen* tree: *bark* warm brown, *rugose-fissured* rather coarsely, *becoming thickly shaggy with dead fibrous oblong scales* when old: inner bark pale brown, waxy-amber and translucent near the cambium: *glabrous.*

Lamina 3–5 × 1–2¼″, oblong-obovate to oblong-lanceolate, shortly and often bluntly acuminate, *base cuneate, dark green, leathery, with numerous close, very faint or practically invisible side-veins,* not glaucous: *petiole* .2–.4″ long, *distinct, stout,* often almost winged, (2–3.5 mm. wide).

Panicles 3–10″ long, *erect terminal,* not foliose (therefore clearly defined): *flowers* 1/3″ wide: *petals blood-red,* with a laciniate or denticulate basal scale: *nectary* cucullate or simple and knob-like, greenish yellow.

Capsule .3–.4″ long, covered for two-thirds of its length by the sepals: seeds winged all round, linear-oblong.

Indochina and W. Malaysia generally.

var **Miquelii** King, Mat. Fl. Mal. Pen. I, *1890,* p. 86.

Lamina ¾–1½″ wide, lanceolate-elliptic or oblanceolate, tapered to a rather long point, thin with the side-veins

and reticulations distinct (though faint) on the underside of living and dried leaves: petiole .05″ wide, rather slender, not winged.

Sumatra, Malaya, Borneo.

C. formosum (Jack) Dyer, F.B.I. I, *1874*, p. 258. (= *C. formosum* auctt.).

A small to lofty *deciduous* tree: *bark* as in *C. arborescens* but cinereous to greyish brown, not so coarsely ridged when young, often only fibrous-fissured, not so thickly scaly: glabrous.

Lamina 2–7 × 1¼–3″, generally broadly elliptic and subacuminate but varying to narrowly elliptic with tapered acute apex, base cuneate, veins prominent and well-spaced, *not or scarcely glaucous beneath, with minute pellucid spots: petiole* ¼–2/3″ long, *conspicuous.*

Flowers .6–.9″ wide, *on the bare twigs* before the new leaves or behind them (*i.e.* on the old wood of the preceding season): *arranged in subsessile clusters of 2–5*, in some cases on a very short raceme up to ½″ long, occasionally solitary, singly on short stalks ¼–½″ long: *petals clear pale pink, with a blunt or irregularly toothed or acute basal scale: nectaries orange-red, conical, acute,* flattened on the inner face, rounded or subcarinate on the outer face.

Capsule ½–¾ × .15–.3″, the sepals covering only the basal third: seeds asymmetric with a unilateral wing.

Indochina, W. Malaysia, Philippines.

C. Maingayi Dyer, F.B.I. I, *1874*, p. 258.

Exactly as *C. formosum* but the lamina narrow, tapered to a point and more or less glaucous beneath, petals white (fide Ridley): (? fewer anthers on each staminal bundle): ? flowers smaller, ½″ wide: ? fruit always smaller ½ × .15″.

Penang, Kedah: probably also in Sumatra and Indochina, *vide infra.*

C. neriifolium Kurz, Journ. As. Soc. Beng. 41, pt. 2, *1872*, p. 293.

Very like *C. Wightii* and *C. racemosum* but the *lamina* narrower, lanceolate or oblong-lanceolate, *almost sessile with an almost sagittate base,* not cuneate: ? smaller flowers.

Burma, Siam, Indochina.

C. polyanthum Korth., Verh. Nat. Gesch. Bot., *1839*, p. 175, t. 36.

A medium- to fair-sized *deciduous* tree: *bark very smooth and even, light buff to pale brownish yellow* (reddish when wet), *peeling with long and irregular or angular thin*

flakes (like pieces of a jig-saw puzzle), never ridged, not fissured or flaky, but rather corky in texture: *inner bark pale emerald green:* glabrous.

Lamina 1½–3½ × .7–1.8″, *elliptic-lanceolate, tapered to a rather long point,* the base tapered cuneate, side-veins distinct but not prominent, *more or less glaucous beneath, not pellucidly punctate* though dotted with opaque glands: *petiole* .1–.2″ long, *short.*

Flowers .3–.4″ wide, *mostly in shortly stalked trichasia,* occasionally solitary, *in the axils of the current foliage leaves* (*i.e.* produced on the new wood after the new leaves), *the uppermost leaves on a flowering twig generally smaller than the lower, or in short panicles,* 1–2″ long, *the lower branches trichasial,* the upper uniflorous, and without leafy bracts, the panicles terminal or from the upper leaf-axils: *petals delicate pink* (as in Korthals' figure), *without a basal scale: nectary yellow, hooded or saccate* (cucullate), *opening on the outer face, large,* occasionally minute, oblong and simple (as in Korthals' figure).

Capsule .3–.4″ long, ellipsoid, covered for ⅔–¾ its length by the sepals: seeds with unilateral wing.

Northern India throughout W. Malaysia to the Philippines.

C. pruniflorum Kurz, For. Fl. Burma I, *1877,* p. 84.

Exactly like *C. formosum* but with hairy leaves, twigs and flowers; lamina oblong-elliptic, not pellucidly punctate; nectaries cubic, truncate (not acutely conic) (*fide* Gagnepain).

Burma, Indochina, Siam.

C. racemosum Bl., Mus. Bot. Lugd. Bat. II, *1852,* p. 16.

Like *C. Wightii* but becoming a bigger tree: *lamina longer,* up to 8″, *the base obtuse or rounded, the apex tapered to a point, the petiole very short,* .1″ long or less: apparently with erect panicles of smaller flowers, .4″ wide (petals 7–8 mm. long, staminal bundles 5–6 mm.) and with smaller capsules 1/3″ long.

Java, ? Sumatra *vide infra.*

C. Wightii Bl., Mus. Bot. Lugd. Bat. II, *1852,* p. 18.

= *C. polyanthum* var. *Wightii* Dyer, F.B.I. I, 1874, p. 257.

Very like *C. polyanthum* but: a shrub or small tree to 30′ high: *bark* as in *C. formosum, greyish-brown, cracked, fissured or rugose,* the inner bark yellowish amber, translucent, with yellowish gum.

Lamina 2¼–4¾ × 1–1¾″, *oblong-elliptic, generally blunt or subacute,* the leaves at the ends of the twigs or

the leafy bracts sometimes tapered more or less to a point, distinctly glaucous beneath.

Flowers larger, .5–.6″ wide, *in terminal or axillary many-flowered racemes* 2–6″ long, *the pedicels uniflorous* but arranged in pairs, *the racemes commonly with leafy bracts* especially in their proximal parts and forming a loose panicle at the end of the twig, always distinct from the leafy shoots: *petals light crimson,* the mass of flowers appearing red.

Capsule slightly larger .4–.5″ long.

Burma, Indochina, Siam. North of Malaya (Penang, Kedah, Kelantan).

(*C. polyanthum,* sepals 4–6 mm. long, petals 6–8 mm., staminal bundles 4–6 mm.: *C. Wightii,* sepals 6–8 mm. long, petals 8–10 mm., staminal bundles 7–8 mm.).

The inflorescences of *C. polyanthum* and *C. Wightii* are essentially similar but they differ in the development of the bracts, or flowering leaves, and in the arrangement of the flowers. In *C. polyanthum* the pedicels are mostly 3-flowered, in *C. Wightii* mostly 1-flowered. In *C. polyanthum* the bracts are mostly so large as to appear like slightly reduced leaves or they may be as large as the leaves themselves, and thus the twigs appear leafy with axillary flowers and only somewhat reduced leaves at their ends. But from the terminal bud, or from one in an upper leaf-axil, a short panicle, 1–2″ long, with minute bracts may be developed. Such inflorescences are much better developed in *C. Wightii,* in which they are racemose (through the uniflorous pedicels) and 2–6″ long: they may have minute, bladeless bracts or leafy bracts, ¼–1″ long. In *C. Wightii,* also, there is generally a distinct difference in size between the foliage leaves and those which subtend the flowers, and thus the twigs appear to end in leafy panicles with racemose branches.

It must be confessed, however, that herbarium-specimens do not always convey a good idea of the differences between the two species.

It will be seen that *C. Wightii, C. polyanthum, C. racemosum* and *C. neriifolium* are closely allied, on the one hand, through their habit of flowering on the leafy twigs at the end of their new growth, their very short petioles, their leaves not pellucidly punctate, their more deeply coloured petals without a basal scale, their large yellow cucullate, or invertedly saccate, nectaries and their ellipsoid capsules covered for ⅔–¾ their length by the sepals. On the other hand, *C. formosum, C. Maingayi* and *C. pruniflorum* are closely allied through their habit of flowering from the axils of the freshly fallen leaves, through their

longer petioles, their white or pale pink, never red, petals which have a basal scale, their simply conic or knob-like orange-red nectaries and their oblong capsules covered by the sepals only in the basal third. *C. arborescens* differs from both groups in being evergreen, with upright panicles of small flowers and in its seeds which are winged all round (in the other two groups the seed has a unilateral wing).

It must be noted that all species of Cratoxylon, apparently, begin to mature when they are still small enough to enable one to pick the flowers from the branches. The small size of the tree is therefore not diagnostic but I am doubtful if *C. Wightii* and *C. pruniflorum* under any circumstances reach even half the size of full-grown specimens of *C. formosum, C. polyanthum* and *C. arborescens.*

With these facts we can now turn to the identity of Loureiro's and Jack's species.

Hypericum cochinchinense Lour., Fl. Cochinch. *1790*, p. 472. The important points in Loureiro's description are:—

"Arbor mediocris, 16-pedalis.....
Folia lanceolato-ovata, obtusa.....glabra.....
sub-petiolata.....
Flos coccineus, pedunculis subquinquefloris, axillaribus.....
Nectarium glandulis 3, magnis, reclinatis.....
Capsula ovata.....
Florum succus tingit colore aureo."

In other words, a small tree flowering on its leafy twigs (with few-flowered peduncles from the leaf-axils), shortly stalked leaves, red petals (without mention of a basal scale) and large "reclinate" nectaries indicates *C. polyanthum, C. Wightii, C. racemosum* or *C. neriifolium.* The blunt leaf and red flower refute *C. polyanthum* and *C. racemosum* and indicate one of the other two. The absence of any mention of the almost sagittate leaf-base typical of *C. neriifolium,* and the description of the leaf as lanceolate-ovate indicate *C. Wightii.* Now *C. Wightii* is a very common little tree in open country and sandy heaths from the latitude of Penang to the north of Indo-China. The only doubt that *H. cochinchinense* may not be *C. Wightii* lies in the Loureiro's description of the inflorescence. But when the flowering of *C. Wightii* is beginning, as I have seen from many trees in Kelantan and Kedah, the first formed inflorescences are "pedunculis subquinquefloris, axillaribus": it is the subsequent ones from the newer leaf-axils that are racemose and many-flowered and give to the twigs the appearance of ending in loose leafy panicles. I therefore identify *H. cochinchinense* with *C. Wightii,* and say that Loureiro drew up his description from plants that were just beginning to flower.

The first botanist to suggest that *H. cochinchinense* might be *C. formosum* (Jack) Dyer was Pierre but he noted the discrepancies and confessed himself dissatisfied (Fl. For. Cochinch. pl. 51). This suggestion was copied by Gagnepain as if it were a certainty (Fl. Gen. Indoch. I, p. 288) and it is evidently the basis of Merrill's mistake. *C. formosum* has pale pink or white petals, simply conic, straight, rather small nectaries, comparatively long petioles and oblong not ovate capsules: it flowers from its bare twigs. If *H. cochinchinense* can be turned into *C. formosum*, there will no more object in describing plants in detail: for all Cratoxylons could then be turned into one species.

The pressed flowers of *C. Wightii* stain the paper bright yellow to golden orange. Those of *C. formosum* give only a faint orange smear from the crushed nectaries.

Elodea sumatrana Jack, Mal. Misc. II, *1822*, No. 7, p. 22. = *Cratoxylon sumatranum* (Jack) Bl., Mus. Bot. Lugd. Bat. II, *1852*, p. 16.

The important points in Jack's description are:—

"Foliis subsessilibus, oblongis attenuato-acuminatis..... paniculis terminalibus foliosis.....petalis basi nudis."

"A large shrub or small tree.....Leaves almost sessile .....*broad at the base*.....6 or 7″ length..... the surface appears by the aid of the microscope to be dotted with opaque points."

"Panicle terminal, foliose, the lower divisions being axillary.....

Flowers dark red or purple.....

Nectaries 3 yellow.....half as large as the petals..... doubled backwards upon themselves in such a manner as to form a sac which opens behind near the base.....

Capsule oblong.....

The leaves are destitute of pellucid dots, and have their lateral nerves strongly and distinctly marked....."

The description indicates the group of *C. polyanthum* but I am unable to decide to which species it should belong because the description seems to fit both *C. racemosum* Bl. and *C. neriifolium* Kurz, with neither of which I have any first-hand acquaintance. At first I thought *E. sumatrana* was *C. polyanthum* itself but that cannot be because *C. polyanthum* is a rather big tree with a tapered-cuneate leaf-base, a smaller leaf-blade (apparently not exceeding 4″ long and generally 2–3″), lateral veins which I consider rather faintly marked in the fresh leaves and pink flowers. Unfortunately Jack omitted the size of the flower, which might have been distinctive. Blume referred to *E. sumatrana* the specimens which Korthals misidentified with *C. Hornschuchii* Bl. and under Korthals' description I find the leaf-base described as "obtuse sæpe biauriculata" as in *C. neriifolium*. Too little is known about the flora of Sumatra to say that *C. neriifolium* does not occur there. Jack himself

thought that *E. sumatrana* might have been *H. cochinchinense* Lour. but Loureiro described the leaf-apex of his species as 'obtusa' and the capsule as 'ovata': moreover *C. Wightii,* which I identify with *H. cochinchinense,* has a cuneate leaf-base as *C. polyanthum.*

I doubt if the identity of Jack's species can be established without resort to the study of Cratoxylon in the type-locality (Tello Dalam, in the island of Pulo Niras). *C. racemosum* Bl. is, at present, its most likely synonym. Are *C. racemosum* and *C. neriifolium* specifically distinct?

Elodea formosa Jack, Mal. Misc. II, *1822,* No. 7, p. 24.
= *Cratoxylon formosum* (Jack) Dyer, F.B. I., I, *1874,* p. 258.

The important points in the description are:—

"Foliis petiolatis, lanceolatis subtus glaucis pedunculis fasciculatis axillaribus.....nectariis acutis.
A small tree with cinereous bark.
Leaves.....acute, glaucous beneath, pellucidly punctate, two and a half inches long.....Petioles slender.
Peduncules.....from the axils of fallen leaves, fasciculate, 1-flowered.
Flowers white, with a slight rosy tinge.....
Petals.....with a broad adnate scale a little above the base.....
Nectaries.....red, acute, carinate behind.....
Capsule oblong.....
Native of Sumatra."

A species of the group containing *C. formosum* auctt., *C. Maingayi* and *C. pruniflorum* is indicated. The absence of any mention of hairs rules out *C. pruniflorum.* I am, however, unable to decide between the others. Concerning *C. Maingayi* we know very little and that little reveals no other distinction from *C. formosum* auctt. than a rather narrow, more pointed, and shorter-stalked leaf and, *teste* Ridley, white petals for *C. Maingayi.* From the figure given by King (Ann. Roy. Bot. Gard. Calc. V. pt. 2, *1896,* t. 165), *C. Maingayi* seems also to have fewer anthers in a staminal bundle than *C. formosum* auctt., but one cannot say how accurate is this feature of the plate. In all three species, *C. pruniflorum, C. formosum* and *C. Maingayi,* the leaves tend to be glaucous beneath. On the face of it, one would identify *E. formosa* Jack with *C. Maingayi* Dyer. This would mean that *C. formosa* auctt., which is undoubtedly *Tridesmis formosa* Korth., would have to be given a new specific epithet, presumably that from *Tridesmis ochnoides* Spach to which Blume reduced Korthals' species.

I think, myself, however that *C. Maingayi* is only a white-flowered variety of *C. formosum* auctt. which is a variable species. In Singapore *C. formosum* auctt. has two varieties, the one being smaller by a half to two-thirds in

linear measure than the other. The small variety has a more narrowly fissured bark with smaller scales, rather small and almost lanceolate, acute leaves ¾–1¾″ wide, smaller flowers .5–.6″ wide, and narrower capsules .15″ wide: it is moreover a smaller tree, reaching only 50–60 ft. high. The larger variety has rather coarsely fissured and scaly bark as in *C. arborescens,* rather broadly elliptic and bluntly subacuminate leaves 1½–3″ wide, flowers .7–.9″ wide and capsules .25–.3″ wide: it reaches 120 ft. high. The small variety is deciduous by branches: the large is wholly deciduous at once. Moreover, independently of these distinctions, the leaves of some trees are distinctly glaucous beneath, and others are not at all. The study of such variation must be made on living trees. Gagnepain gives the flowers of *C. formosum* auctt. as "blanches, rosées" (Fl. Gen. Indoch. I, p. 289), and he describes a var. *Thorelii* which has the distinctions of *C. Maingayi.* I cannot decide whether two recent collections from Sumatra, Bartlett 7687 and 7907, should be *C. formosum* auctt. or *C. Maingayi,* or *C. formosum* var. *Thorelii.* I am not certain even that *C. pruniflorum* is specifically distinct.

I think that the exact identification of *E. formosa* Jack cannot be decided until the living plants of Sumatra have been better studied. It is certain however, as I have shown above, that *C. formosum* (Jack) Dyer is not a synonym of *C. cochinchinense.*

Under the circumstances it is preferable to follow at present Dyer, King, Pierre, Gagnepain, Koorders, Ridley, etc. who give the name *C. formosum* to the common, glabrous Cratoxylon with clusters of pink flowers on its bare twigs and to keep *C. Maingayi* for a state with white flowers.

It must be noted that *E. formosa* Jack (*1822*) and *Tridesmis formosa* Korth. (*1839*) were independent binomials, though both reduced to *T. ochnoides* Spach by Blume and to *C. formosum* (Jack) Dyer by Dyer. Korthals' species is what has always been meant by *C. formosum,* since the publication of the Flora of British India.

Cratoxylon ligustrinum (Spach) Bl., Mus. Bot. Lugd. Bat. II, *1852,* p. 16.

= *C. polyanthum* Korth. Verh. Nat. Gesch. Nederl. Overz. Bez. Bot. *1839,* p. 175, t. 36. (*fide* Dyer, F.B.I. I, *1875,* p. 257).

The identification of *Ancistrolobus ligustrinus* Spach with *C. polyanthum* appears to have been made by Dyer. There has been no botanical proof, so far as I can ascertain, but I suppose one must believe it as other botanists have done.

Dyer also reduced *C. Wightii* Bl. to *C. polyanthum* as var. *Wightii* and this identification has also been taken on trust. I find, however, that the plants which grow in the north of Malaya and which have been identified correctly, without doubt, with var. *Wightii* from Burma, Siam, and Indochina cannot be considered the same species as *C. polyanthum.* The chief difference between them lies in the bark which in *C. polyanthum* is like that of a plane tree (*Platanus occidentalis*), though as smooth as that of a Eucalyptus or Tristania when the bark has peeled, and in *C. Wightii* is rugged and scaly. The species also differ in habit, *C. Wightii* being a shrub or small tree and *C. polyanthum* commonly a big tree, in the development of the inflorescence, in the flower-size and in the leaf-shape. They are certainly closely allied but I have never seen or read of another species of tree that might vary into two so different bark-characters. I find the bark-characters of trees in Malaya remarkably constant. Some kinds of tree, admittedly, may change their bark as they grow, as the scaly or shaggy bark of young Eucalyptus and Tristania gives way to the smooth trunks, and that of *Cratoxylon arborescens* also changes rather strikingly. But I have purposely examined this possibility by studying saplings of *C. Wightii* in Kedah and Kelantan, and of *C. polyanthum* in Penang, Pahang, Johore and Singapore. *C. polyanthum* always has smooth bark from the sapling state. Kurz and Pierre also describe the characteristic bark of *C. polyanthum.* Presumably *C. ligustrinum* had smooth bark.

If botanists prefer to unite *C. Wightii* and *C. polyanthum,* then the correct name for *C. polyanthum* will be *C. cochinchinense* var. *ligustrinum* (Dyer), because *C. polyanthum* var. *Wightii* Dyer is identical with *C. cochinchinense.*

As synonyms of *C. ligustrinum,* Merrill has given *Hypericum olympicum* (non Linn.) Lour. and *H. petiolatum* (non Linn.) Lour., and I wish to draw attention to these in order to show with what caution unproven identifications should be admitted into systematic botany. In the first place there are no such species as *H. olympicum* Lour. and *H. petiolatum* Lour. Loureiro opened each description with the diagnosis of, and citation to, the Linnean species as described in Sp. Plant. Ed. 2. That he was uncertain of his identification of the Cochinchinese plants with *H. olympicum* L., Loureiro showed by a query, and that he considered the plant called "Le nganh tlang" might be typical and the plant called "Hoang xoc" might be a variety, he showed by the greek letters for a and b, as was the custom, and the first vernacular name he also queried. The

Cochinchinese plant which he identified with *H. petiolatum* L., Loureiro considered to be a variety of the Linnean species by 1. writing the greek letter for b only after the specific name, 2. omitting the words "subtus tomentosis" for the leaves from the Linnean diagnosis and 3. writing "vix tomentosa" for the leaves in his own description. In other words these Cochinchinese plants were not described under any new names, specific or varietal, by Loureiro.

As for the identification of the Cochinchinese plants, in the second case, Loureiro wrote in his own description under *H. olympicum* "Flos luteus, pedunculis incanis" and under *H. petiolatum* "Caulis fruticosus, multiplex, 3-pedalis, angulatus, diffusus.....Flos flavo-ruber". If it is possible to identify both these Cochinchinese plants as *C. ligustrinum* from Loureiro's description alone, then surely botanists are entitled to an explanation of how the description of a pink-flowered timber-tree can be made to fit that of a yellow-flowered, 3-foot shrub. Unless his descriptions are utterly fallacious, it seems to me that Loureiro's plants must have been species of Hypericum.

Cratoxylon arborescens (Vahl) Bl., Mus. Bot. Lugd. 2. *1852,* p. 17.

= *Hypericum arborescens* Vahl., Symb. II, p. 86, t. 43 fide Blume.

If the Malayan specimens have been correctly identified as *C. arborescens* then this species has never been properly described. It was believed to have no basal scale to the petal until King discovered that it had a "laciniate scale". (Mat. Fl. Mal. Pen. I, *1890,* p. 86). The nectary has not, however, been described specifically, though Dyer placed the species in the section with more or less cucullate nectaries. I have examined all the specimens in the Singapore Herbarium and found that, out of 78, 16 have the large cucullate nectaries typical of *C. ligustrinum* and the rest have a simple nectary like a very small oblong knob, as may occur also in *C. ligustrinum*: in some cases, it is so rudimentary that it is merely a point between the staminal bundles. But these specimens could not be distinguished by any other constant feature, hence it is evident that the nectary varies between the states of the section Ancistrolobus and that of the section Tridesmis. This variation also occurs in the specimens which Ridley has referred to *C. microphyllum* Miq. The colour of the nectary I do not know. As for the scale on the petal, I found it was conspicuous and deeply laciniate in most specimens but in a few it was small and denticulate and even vestigial like the nectary.

C. arborescens is, perhaps, the commonest species of the genus in the high forest in Malaya.

The variety *Miquelii* in its typical state is well-characterised by its thin, narrow and pointed leaf with slender petiole, but I believe that there are intermediates. Ridley considered that var. *Miquelii* had smaller flowers than the typical *C. arborescens* but I have recently been able to examine the flowers of several trees of the var. *Miquelii* on Fraser's Hill, in Pahang, and I could find no difference whatever: in both type and variety they vary from .3–.4″ wide across the petals: in structure, both flower and fruit are identical, var. *Miquelii* also having both kinds of nectary and occasionally none at all. Nor is there any difference in the size of the trees as Mr. C. F. Symington has informed me and as I have learnt also from a study of the trees on Penang Hill and Fraser's Hill: those of var. *Miquelii* will reach 100 ft. though they may begin to flower at 12 ft. The Malayan collections indicate that *C. arborescens* (typical) is a lowland and, predominantly, swamp-loving tree and that var. *Miquelii* occurs on the hillsides and mountains from low levels to an altitude of 4,000 ft. A comparison of living specimens at intermediate levels is much to be desired, in the high-level swamps of foot-hills for instance.

Cratoxylon microphyllum Miq., Fl. Ind. Bat. Suppl. I, *1860*, p. 500. Ridley F.M.P. I, *1922*, p. 153.

The Malayan specimens referred by Ridley to Miquel's species are Derry 636 (Mt. Ophir, 1890, 3,000 ft.) and Ridley s.n. (Mt. Ophir, June, 1892). In the Singapore Herbarium there are also the following sheets of the same species as the Malayan:—

Haviland s.n. Sarawak.
Haviland 72, Braang, Borneo Nov. 1888 (2 sheets).
Hullett 5697 Gunong Dai, Lingga, Borneo, July 1893.
Horsfield s.n.ex Herb. Mus. Brit. (2 sheets).
Native Collector 370 Sarawak, det. *C. glaucum* Korth.
Native Collector 639 Sarawak, det. *C. glaucum* Korth.

I am doubtful if this species, which for convenience I will call *Cratoxylon A*, is either *C. microphyllum* or *C. glaucum*. Korthals described *C. glaucum* with glabrous leaves, cucullate nectaries and without a basal scale to the petal. Apparently the same applies to *C. microphyllum* which Miquel also placed in Cratoxylon (no petal-scale) in contrast with Tridesmis (with a petal-scale). *Cratoxylon A* has a distinct, small denticulate petal-scale: the underside of the leaves appears minutely felted in the areolæ as though there were stomatal pits covered with decumbent, moniliform hairs of inflated oval or globose cells. *Cratoxylon A* is certainly very close to *C. arborescens*, differing in its

smaller leaves with this peculiar epidermal structure on the undersurface, its distinctly larger flowers and its smaller and merely denticulate petal-scale. Its seed is winged all round as in *C. arborescens:* it shows the same variation in the form of the nectary: and I have little doubt that it is evergreen.

The Subdivision of Cratoxylon

Cratoxylon was monographed first and last by Blume (Mus. Bot. Lugd. Bat. II, *1852*, 15). Several species have been added since without the old ones having been re-described or, in some cases, even recognised. Consequently, botanists do not know 'where they are' when they wish to study the species of their country. A revision is much wanted. I put down some notes for the arrangement of the triadelphous members of the genus.

Section 1 (a new section is needed)

Evergreen: sapling without spines on the trunk: flowers in terminal, erect panicles: *petals* blood red with a laciniate or denticulate scale at the extreme base: *nectary* greenish yellow cucullate or small and knob-like in the same species: *capsule* covered for ½–⅔ its length by the sepals, the petals generally caducous: *seeds* oblong, winged all round.

C. arborescens, Cratoxylon A (p. 32).

Section 2. (*Ancistrolobus* Spach)

Deciduous: sapling with spines on the trunk (*C. cochinchinense, C. ligustrinum*): flowering at the ends of the new shoots: *panicles* erect or drooping, distinct or leafy at the base, or with short racemes from the leaf-axils to form a leafy panicle, or with axillary few-flowered cymes: *petals* deep red or pink, without a basal scale: *nectary* yellow, large cucullate: *capsule* covered for ⅔–¾ its length by the sepals, the petals generally persistent (c.f. the length of capsule and sepal): seeds with a unilateral wing.

C. cochinchinense, C. ligustrinum, C. neriifolium, C. racemosum, C. sumatranum.

Section 3 (*Tridesmis* Spach, pro parte 'triadelphia')

As Section 2 but:—flowering from the axils of the fallen leaves, on the last season's twigs before or with the new leaves: *inflorescences* as short few-flowered cymes, or clusters: *petals* white or pale pink, with a basal scale entire or denticulate, and adnate to the petal for a short distance: *nectary* red or orange-red (? in all), conic or knob-like, rather small: *capsule* covered for ⅓ or ¼ of its length by the sepals, the petals caducous.

C. formosum, C. Maingayi, C. pruniflorum.

Synonymy

Cratoxylon arborescens (Vahl) Bl., Mus. Bot. Lugd. Bat. II, *1852*, p. 17.

Hypericum arborescens Vahl, Symb. II, *1791*, p. 86, t. 43 (fide Blume).

Ancistrolobus glaucescens Turcz., Bull. Mosc. I, *1858*, p. 383 (fide Dyer).

C. arborescens var. **Miquelii** King, Fl. Mal. Pen. I, *1890*, p. 86.

C. cuneatum Miq., Fl. Ind. Bat. I, pt. II, *1859*, p. 517 (fide King).

Cratoxylon cochinchinense (Lour.) Bl., Mus. Bot. Lugd. Bat. II, *1852*, 17.

Hypericum cochinchinense Lour., Fl. Cochinch., *1790*, p. 472.

Cratoxylon Wightii Bl., loc. cit. p. 18.

Ancistrolobus sp. Wight, Illustr. I, *1840*, p. 111.

Cratoxylon polyanthum var. *Wightii* Dyer, F.B.I. I, *1874*, p. 257.

non *C. cochinchinense* sensu Merrill [Tr. Am. Phil. Soc. 24, pt. II, *1935*, p. 268=*C. formosum* (Jack) Dyer].

Cratoxylon formosum (Jack) Dyer, F.B.I. I, *1874*, p. 258. *Elodea formosa* Jack, Mal. Misc. II, *1822*, No. 7, p. 24 (sensu Dyer).

Tridesmis formosa Korth., (non *E. formosum* Jack), Verh. Nat. Gesch. Bot. *1839*, p. 179, tab. 37.

Tridesmis ochnoides Spach, Hist. Veg. Phan. V, *1836*, p. 359 (fide Blume).

Tr. Billiardieri Spach, Nouv. Ann. Sci. Nat. V, *1836*, 352, t. 6 (fide Blume).

Tr. Jackii Spach, loc. cit. (fide Blume).

Hypericum aegiptium Blanco, Fl. Filip., *1837*, p. 615 (fide Blume et Merrill).

Cratoxylon cochinchinense (Lour) Bl., sensu Gagnepain (Fl. Gen. Indoch. I, p. 288) et Merrill (Tr. Am. Phil. Soc. 24, pt. II, *1935*, p. 268).

Cratoxylon formosum auctt., sed ? *E. formosum* Jack (?=*C. Maingayi* Dyer).

Cratoxylon ligustrinum (Spach) Bl., Mus. Bot. Lugd. Bat. II, *1852*, p. 16.

Ancistrolobus ligustrinus Spach, Nouv. Ann. Sci. Nat. V, *1836* p. 352 t. 63.

Hypericum chinense Retz., Observ. V, *1789*, p. 27 (fide Blume) (non *H. chinense* Linn.)

Hypericum biflorum Lam., Encycl. IV, *1796,* p. 170 (non *Cratoxylon biflorum* Turcz.).

Cratoxylon polyanthum Korth., Verh. Nat. Gesch. Bot., *1839,* p. 175, t. 36 (fide Dyer).

Ancistrolobus brevipes Turcz., Bull. Mosc. I, *1858,* p. 383 (fide Dyer).

Cratoxylon laceolatum Miq., Fl. Ind. Bat. Suppl. I, *1860,* p. 500 (fide Dyer).

Cratoxylon biflorum Turcz., Bull. Mosc. 36, *1863,* p. 580 (fide Merrill) (non *H. biflorum* Lam.).

Cratoxylon polyanthum var. *ligustrinum* Dyer, F.B.I. I, *1874,* p. 257.

Cratoxylon chinense (Retz.) Merrill, Philipp. Journ. Sci. Bot. 4, *1909,* p. 292.

Cratoxylon Maingayi Dyer, F.B.I. I, *1874,* p. 258.

? *Elodea formosa* Jack, Mal. Misc. II, *1822,* No. 7, p. 24: [*Cratoxylon formosum* (Jack) Dyer, F.B.I. I, *1874,* p. 258].

Cratoxylon sumatranum (Jack) Bl., Mus. Bot. Lugd. Bat. II, *1852,* p. 16.

Elodea sumatrana Jack, Mal. Misc. II, *1822,* No. 7, p. 16.

? = *Cratoxylon racemosum* Bl., Mus. Bot. Lugd. Bat. II, *1852,* p. 16.

Conclusions on Cratoxylon

C. cochinchinense (Lour.) Bl. is identified with *C. Wightii* Bl. (=*C. polyanthum* var. *Wightii*). It is considered a distinct species from *C. ligustrinum* (Spach) Bl. (= *C. polyanthum* Korth.). Merrill's identification of *C. cochinchinense* with *C. formosum* auctt. is shown to be untenable. *C. Wightii* is therefore reduced to *C. cochinchinense.*

C. sumatranum (Jack) Bl. may be *C. racemosum* Bl. or *C. neriifolium* Kurz. but it is considered unidentifiable at present, though most probably the former.

C. formosum (Jack) Dyer appears to be identical with *C. Maingayi* Dyer but until the flora of Sumatra is better known it is advisable to follow the usual interpretation of the species on *Tridesmis formosa* Korth. as given by Dyer, King, Koorders, Gagnepain, etc. and to regard *C. Maingayi* as, perhaps, a white-flowered form.

C. ligustrinum (Spach) Bl. appears to be the correct name for *C. polyanthum* Korth. The differences from *C. cochinchinense* (= *C. Wightii*) are given.

There are no such species as *Hypericum olympicum* Lour. and *H. petiolatum* Lour. The plants referred by

Loureiro to *H. olympicum* Linn. and *H. petiolatum* Linn. are not *C. ligustrinum* but, probably, species of *Hypericum.*

The occurrence of *C. microphyllum* Miq. in Malaya is doubtful.

An arrangement of the triadelphous species is suggested, but the whole genus is in need of revision.

GUTTIFERÆ

Garcinia

G. Cowa, G. nigrolineata, G. parvifolia, G. globulosa

These species have been so confused in the Malayan flora that their differences have not yet been clearly stated. Ridley attempted to straighten the confusion in 1910 by defining *G. nigrolineata* afresh, and distinguishing *G. globulosa* as a new species from *G. parvifolia* (Journ. Str. Br. Roy. As. Soc. 54, *1910*, p. 18). I find that Ridley's idea of *G. nigrolineata* covers also *G. Cowa* and that *G. globulosa* is not distinguishable from *G. parvifolia.*

I make the diagnostic features of the three to be these:—

Male flowers 10–13 mm. wide with short thick pedicels 4–8 mm. long: *petals* 7–10 × 5–6 mm. broad, *yellow flushed pink or red:* stigma 4–6 mm. wide: *fruit longitudinally grooved* ..... *G. Cowa*

Male flowers with rather slender pedicels: *petals clear pale yellow: fruit not grooved*

Male flowers 10–13 mm. wide with pedicels 9–14 mm. long: *petals* 6–8 × 2–3 mm., ligulate, *reflexed in the middle,* persistent on the fruit: calyx of female flowers 10–13 mm. wide: *fruit umbonate, faintly ribbed, the umbo tipped with the stigma* 2.5–3.5 mm. wide: *seeds large with little pulp,* (in t.s. of fruit, seeds 8–14 mm. wide, pulp 2 mm. wide) ..... *G. nigrolineata*

Male flowers 7–10 mm. wide with pedicels 4–10 mm. long: *petals* 4–6 × 2.5–4 mm., *not reflexed,* caducous: calyx of female flowers 4–6 mm. wide: fruit round or oblong, occasionally umbonate, *the stigma and calyx generally deeply sunken,* the stigma 1.5 mm. wide: *seeds small with much pulp* (in t.s. of fruit, the seeds 3–5 mm. thick, the pulp 3–5 mm. thick) ..... *G. parvifolia*

It is often very difficult to distinguish the species by leaf. *G. parvifolia* has elliptic, acuminate or caudate leaves; *G. Cowa* has lanceolate elliptic, simply acute leaves; *G. nigrolineata* has ovate-lanceolate, acuminate leaves often larger and generally drying brown with fine, short black lines.

G. Cowa Roxb., Fl. Ind. 2, *1832,* p. 622.

As understood by King (Mat. Fl. Mal. Pen. 1, p. 104), *G. Cowa* differs from *G. Kydia* in its smaller male flowers

(.4″ wide in *G. Cowa*, .75″ in *G. Kydia*), in its groups of 3–8 female flowers (solitary in *G. Kydia*), its fruits being grooved from base to apex and its stigma not raised on an umbo (the fruit of *G. Kydia* grooved only near the apex and with the stigma on an umbo).

I have seen many trees of *G. Cowa* in the north of Malaya and have compared them with trees of *G. Kydia* in the Singapore Botanic Gardens. I find that the difference in size of the male flowers (the petals of *G. Kydia* being 10–14 × 6–10 mm.) and in grouping of the female flowers holds with the addition that the petals of *G. Kydia* are clear pale yellow while those of *G. Cowa* are flushed pink or red, but that the differences in the fruit do not hold. The fruit of *G. Cowa* in Malaya may be umbonate or not, with grooves proceeding from base to apex or at the apex only, and with the stigma sunken or not. On the other hand, the fruits of *G. Kydia* in Singapore ripen orange-red and are slightly ribbed, not grooved, while those of *G. Cowa* turn orange-ochre. The leaves of the two species seem identical.

I think it better to follow Hooker and make *G. Kydia* a variety of *G. Cowa*.

G. nigrolineata Anderson, F.B.I. 1, *1874*, p. 263.

Ridley mistakenly attributed the species to Pierre who, according to King, partly misinterpreted Anderson's species. It is based on the Malaccan collections of Griffith and Maingay.

The critical points in Anderson's description are the rather large, ovate-lanceolate leaf drying ferruginous beneath, the long pedicels of the male flower (¼–½″), the reflexed petals, and the stipitate stigma of the fruit. From these, I identify the Malayan specimens.

As pointed out by Ridley, King confused the much commoner *G. parvifolia* with *G. nigrolineata*.

G. parvifolia (Miq.) Miq., Ann. Mus. Lugd. Bat. 1, p. 208.

Basinym: *Rhinostigma parvifolium* Miq., Fl. Ind. Bat. Suppl. *1862*, p. 495.

Synonym: *G. globulosa* Ridley, Journ. Str. Br. R. As. Soc. 54, *1910*, p. 20.

Not having seen Miquel's type, I follow King and Ridley in their interpretation of it. Ridley distinguished *G. globulosa* from *G. parvifolia* by its smaller leaves, smaller male flowers and smaller round fruit with sunken stigma and no umbo. The leaves are, however, much more variable in size than Ridley has given, being 2–6 × ¾–2¼″. I can detect no difference in the size of the male flowers and, though Ridley gave about 20 stamens for *G. globulosa* and 30 for *G. parvifolia*, I find that their number may vary from

15–30 on the same tree. As regards the fruit, the extreme states described by Ridley seem very distinct but they are connected by every intermediate and I have seen one tree which had both small round fruits, ½″ wide, and oblong fruits, 1¼ × ¾″, with the stigma concealed either in a pit or almost flush with the surface. Hence, I think that *G. globulosa* cannot even be distinguished as a variety. It may be remarked that the variation of tropical trees is commonly surprising and that it cannot be judged from preconceived ideas about plants.

RUTACEÆ

Zanthoxylum

Z. rhetsa D.C.

This Indo-Siamese species must be added to the Malayan flora. I have seen that it is not uncommon in the rice-fields and secondary jungle (belukar) in the neighbourhood of Kota Bahru in Kelantan. I was fortunate in finding two trees, about 60 ft. high, the one with male flowers and the other with female flowers and fruits, so that the identity of the species was without doubt. The tetramerous flower, unilocular, bi-ovulate ovary, and entire, very asymmetric, acuminate leaflets are characteristic. The species is clearly dioecious. Although I did not meet it in the high forest (most probably because I had no time to explore the forest), it was so evidently at home with *Dillenia aurea*, Streblus, Cratoxylon, Eurya, Decaspermum, Buchanania, and so on, in the belukar that there could be no doubt of it being a natural element of the flora.

To the local Malays it is well-known as "Hantu Duri" or "Hantar Duri". The hard black seeds are used by children in their pea-shooters.

SAPINDACEÆ

Allophylus

In the most recent revision of the genus by Radlkofer a very large number of species are described, about 180 in all, and seven species are ascribed to Malaya (Pflanzenr. 4, *1932*, p. 165). Ridley made five species for Malaya, but King and Hiern considered that there was only one.

A perusal of Radlkofer's work shows that the species are grouped primarily according to geographical distribution, whether American, African or Asiatic, and that there is no attempt to relate the species of the three "regions." In the second place, not one structural floral difference is mentioned in the whole genus, so that the species are separated on vegetative characters or on slight differences

in the size of the flower. In the third place the key to the species is impracticable so far as the Malayan flora is concerned. I have therefore examined the material in the Singapore Herbarium as critically as possible.

I have dissected the flowers of every available specimen from species Asiatic, African and Australian. The structure of the flower, as well as that of the inflorescence and fruit, I find to be identical and only trivial variations in the size of the flower and the shape of the petals can be discovered. The 'specific' differences relate only to the leaves (shape, size, toothing), the twigs (colour) and the branching of the inflorescence. And, so far as the Malayan specimens are concerned, these differences are not constant but all are bridged by one or more collections. Hence I follow King, Hiern, Koorders and Valeton (Bijdr. Booms. 9, p. 148) and refer all our Malayan collections to the one species, *A. cobbe* (L) Bl. The differences between the Malayan "species" are such as one finds in any common and variable plant like *Taraxacum officinale, Hevea brasiliensis* or *Ixora javanica,* and are in no way comparable with the differences in structure of flower and fruit by which one normally distinguishes a species, *e.g.* in Mangifera, Ficus, Cassia. Indeed, I wonder if there are even 10 good species in the whole genus. I have, therefore, no hesitation in combatting the "splitting" into micro-species which is becoming more and more popular in the study of dried specimens of tropical plants.

Two characters which Radlkofer employs to distinguish groups of "species" are the colour of the twig and the branching of the inflorescence. But these are unreliable. *A. glaber* sensu Radlkofer has dark young twigs and pale old ones and it has simple and branched inflorescences on the same plant or on plants which differ in no other respect. Moreover, Radlkofer overlooks differences in the size of leaflet, petiole and petiolule, the number of veins and the presence or absence of hair-tufts in the axils of the lateral veins on the underside of the leaf, which points lend further variety. Thus Ridley 7364, placed by Radlkofer in *A. racemosus,* is different from Kunstler 10238 also placed by Radlkofer in *A. racemosus:* they differ in general hairiness as well as in leaf-size and the presence of axillary hair-tufts. There are several differences also in the colour of the fresh leaves and the ripe fruits which one may consider equally "specific" with those of the dried leaves and dried twigs. Yet one would not make species on such variations.

Hiern distinguished several varieties of *A. cobbe* in the Flora of British India. I am unable to follow his treatment, the varieties not being typified, and so I have proposed five new varieties for the Malayan flora.

The remarkable, evolutionary state of Allophylus cannot pass unheeded, nevertheless. There is great variety in leaf-size, toothing, hairiness and branching of the inflorescence and yet such conspecific uniformity in flower and fruit. I do not know a like condition in another genus.

A. cobbe (L) Bl.

Key to the Varieties

Twigs, petioles and undersides of leaf-blades closely hispid-velvety, the hairs 1–2 mm. long, the lamina often glabrescent: inland	var. *villosus*
Twigs and petioles glabrescent or only finely velvety, the hairs less than .5 mm. long, the leaf-blade never velvety beneath: often coastal	
Leaflets without axillary hairtufts to the nerves	var. *glaber*
Leaflets with axillary hairtufts to the nerves	
Twigs, petioles and both sides of the midrib persistently finely velvety: rocky and sandy coasts	var. *velutinus*
Twigs, petioles and midribs glabrous or glabrescent	
Leaflets broadly elliptic or ovate, 4–10 cm. wide: rocky and sandy shores of the East coast	var. *marinus*
Leaflets lanceolate, 2–6.5 cm. wide: mangrove	*var. limosus*

var. **glaber** var. nov.

Novellis sparse pubescentibus, mox glabrescentibus; foliolis 8–28 × 2.5–10.5 cm., ovato-ellipticis, subcoriaceis, integris vel subdentatis, costis lateralibus utrinsecus 8–12, *axillis costarum pilis deficientibus:* petiolis 2.5–14 cm. longis: thyrsis 10–25 cm. longis, simplicibus vel 1–3 ramis præditis, subhirsutis vel glabris: ramulis primo fuscis dein pallidis.

Type:—For. Dept. 28173, leg. Jaamat, Sungei Lemoi, Pahang, 14.9.31.

Collections:—

KEDAH: Haniff & Nur 7157.
PENANG: Cantley 14, Curtis 771, 1465 (? 1466), 2288, 2776, Kunstler 1583.
PERAK: Burkill and Haniff 12993, Kunstler 4293, 8206, Scortechini 290.
PAHANG: For. Dept. 28173, Henderson 10545, 18387, Ridley s.n. 21.8.89.
SELANGOR: Curtis 2330, For. Dept. 524, 3031, 22745, 23081, Goodenough Oct. 1899.
NEGRI SEMBILAN: Alvins 833, Burkill 3544.
JOHORE: Burkill s.n. June 1915 (Pulau Tinggi).

This is like a glabrous form of var. *villosus* but with rather coriaceous leaves. It is also an inland, forest variety with large, many veined leaflets.

var. **limosus** var. nov.

Novellis mox glabrescentibus, ramulis fuscis: foliolis 5–14 × 2–6.5 cm. subcarnosis, *lanceolato-ellipticis,* integris vel vix dentatis, costis lateralibus utrinsecus 7–10, *axillis costarum pilis praeditis:* petiolis 2.5–5 cm. longis: thyrsis 8–16 cm. longis, simplicibus, puberulis.

Type:—Corner 31602, Butterworth, Province Wellesley, 23.7.36.
Collections:—
LOWER SIAM: Haniff and Nur 4217.
LANGKAWI ILS.: Curtis 2869.
PENANG: Curtis 340, 2514.
PROVINCE WELLESLEY: Corner 31602 (type).
PERAK: Fox s.n. Sept. 1904 (Dindings).
SELANGOR: Burkill 352, For. Dept. 4714, 9816.
MALACCA: Alvins s.n. (Merlimau, 21.4.86).
JOHORE: Corner 29773, Ridley s.n. 1905 (Scudai River), Spare F810, F930.
SINGAPORE: Baker s.n. 15.10.17, Cantley s.n., Goodenough 2067, s.n. 5.8.89, Hullett 490, Ridley 273, 1607, 1919, 1919*b*, s.n. 1893.

This variety occurs only in mangrove-vegetation and on brackish tidal mud. Except that it is soon glabrous in all vegetative parts, it is like var. *velutinus.*

var. **marinus** var. nov.

Novellis mox glabrescentibus, ramulis pallide-albidis: foliolis 6.5–20.5 × 4–10 cm., late ellipticis vel ovatis, integris vel subcrenato-dentatis, costis lateralibus utrinsecus 6–9, *axillis costarum pilis praeditis:* petiolis 4–8 cm. longis: thyrsis ramis 1–3 præditis, ± glabris.

Type:—Corner 31495, Pulau Babi Tengah pr. Mersing, Johore, 27.9.36.
Collections:—
PAHANG: Burkill 1031 (P. Tioman), Corner s.n. 17.8.35 (P. Tioman), 29789 (P. Tioman), 29793 (P. Tioman), 29847 (P. Sepoi), 29849 (P. Sepoi), Nur 18905 (P. Tioman).
JOHORE: Burkill 895 (P. Tinggi), Corner 31495 *type* (P. Babi Tengah), s.n. 20.6.34 (Jason Bay).

This variety occurs only on the rocky and sandy shores of the East coast of Malaya, where it is rather common. The large ovate, glabrous leaflets and whitish twigs are characteristic.

var. **velutinus** var. nov.

Ramulis, petiolis costisque velutinosis (pilis vix .5 mm. longis) : *foliolis* 5–13 × 2–6 cm., *parvis,* lanceolato-ellipticis, membranaceis, integris vel serrato-dentatis, laminis vix puberulis, costis lateralibus utrinsecus 9–13, *axillis costarum pilis praeditis: petiolis* 2.5–6.5. longis: thyrsis simplicibus vel ramis 1–2 praeditis.

Type:—Corner 28470, S. Rhu Reba, Jason Bay, Johore, 11.6.34.
Collections:—
PENANG: 3111 (? Curtis).
PERAK: Kunstler 10238, Ridley 3009, Scortechini s.n. Aug. 1884 (Selama), Wray 2021, 3159.
PAHANG: Burn-Murdoch 301, Corner 29863, Ridley 2436, s.n. 20.8.89, s.n. Aug. 1891.
JOHORE: Corner 28470 (type).

This appears to be a coastal variety, though it may also occur inland. It often grows with var. *marinus* on the East coast of Malaya.

var. **villosus** var. nov.

Ramulis, petiolis foliolisque (subtus) *hispidis* (pilis 1–2 mm. longis) haud vel paullo glabrescentibus: foliolis 10–30 × 4–13 cm., ellipticis, membranaceis, dentatis, supra hispidis vel utrinque glabrescentibus, costis lateralibus utrinsecus 10–14, *axillis costarum pilis deficientibus:* petiolis 5–16.5 cm. longis: thyrsis simplicibus vel ramis 1–2 præditis.

Type:—Henderson 21885, Tembeling, Pahang, 14.7.29.
Collections:—
KEDAH: Corner s.n. 10.7.36 (Alor Star).
PENANG: Curtis 2279.
PERAK: Burn Murdoch 190, Curtis 1287, Ridley 9463, 10299, s.n. 1898, Scortechini s.n., Wray 3952.
PAHANG: Henderson 21885, Kiah 23968.
SELANGOR: Ridley 7364.
NEGRI SEMBILAN: Nur 11578.
MALACCA: Alvins 805, 724 (? 924), 1986, Hullett 842.
JOHORE: Ridley s.n. Dec. 1904 (Gunong Pulai).

This is an inland, forest variety distinguished by its large, thin, many-veined toothed leaves and more or less hispid-velvety parts. However, the leaf is more or less glabrescent in some collections and transitions to var. *glaber* appear common.

Collections between var. **glaber** *and var.* **villosus**

PAHANG: Kiah 23924, Nur 11106, Ridley 13501 (? 13581), Seimund 908.
MALACCA: Curtis s.n. April 1901 (Bukit Burong).

The rather long hair on the twigs and young parts, but the glabrescent lamina make it impossible to decide whether these collections should be var. *glaber* or var. *villosus*, both of which lack hair-tufts in the nerve-axils.

Collections between var. **glaber** *and var.* **limosus**

(*a*) Inflorescence simple
PENANG: Burkill 6583.
SELANGOR: Burkill 4410, Ridley s.n. Dec. 1896 (Gua Batu).
JOHORE: Ridley s.n. Nov. 1901.

(*b*) Inflorescence branched
PAHANG: Ridley s.n. Nov. 1900 (Telom).
JOHORE: Ridley 12214.

These collections have slight or distinct tufts of hair in the nerve-axils and thus connect var. *limosus* and var. *glaber*.

Collections between var. **limosus** *and var.* **velutinus**

PERAK: Haniff 15924.
PAHANG: Burkill s.n. June 1915 (P. Tioman).
JOHORE: Corner 31491 (P. Babi Tengah, pr. Mersing).

The twigs and petioles are persistently but finely puberulous in these collections, and Corner 31491 has the laxer venation of var. *limosus*.

Collections between var. **limosus** *and var.* **marinus**

Corner s.n. 29.9.35 (Pulau Merambong, Singapore).

This collection has the large leaflets of var. *marinus* but the dark twigs and more hairy inflorescence of var. *limosus*. The plant was growing on a sandy beach behind a small stand of mangrove. It is very like *A. scandens* except that it was a sprawling shrub.

A. scandens Ridley

Journ. Roy. As. Soc. 75, p. 26.

I consider this a very doubtful species. The herbarium specimen of Ridley's collection from Bukit Panjang in Singapore agrees exactly with Ridley's 12214 from Johore which I place between *A. cobbe* var. *limosus* and var. *glabar*. That there is really a climbing Allophylus in Malaya needs corroboration.

GUIOA

I have dissected the flowers of all the Malayan specimens in the Singapore herbarium and I find that, excepting a few sheets which for lack of material I can identify no further, these specimens fall into four species.

Radlkofer, in his monograph of the Sapindaceæ (Engler's Pflanzenreich IV, 165, *1933*), gives eight species for Malaya, namely:—

No. 10. *G. microphylla* Radlk.
11. *G. fusciulula* (Kurz) Radlk.
12. *G. squamosa* Radlk.
17. *G. diplopetala* (Hassk.) Radlk.
24. *G. pleuropteris* (Bl.) Radlk.
25. *G. bijuga* (Hiern) Radlk.
36. *G. pubescens* (Zoll. et Mor.) Radlk.

Of No. 10 there are no specimens at Singapore. Nos. 11, 12 and 17 I am unable to distinguish and have accordingly followed King in calling all our specimens *G. fuscidula*. I am convinced that, as with Allophylus, the genus has been over-specified.

Floral Differences

Disc entire, annular: petals considerably shorter than the sepals: petal-scales nearly twice as long as the petals: the two outer sepals considerably shorter than the others	*G. fuscidula*
Disc notched or open on one side, incomplete: petals as long as the sepals or longer: petal-scales shorter than the petals	*G. bijuga*, *G. pleuropteris*, *G. pubescens*

Key to the Malayan Species of Guioa

Glabrous or nearly so: leaflets 1–2 pairs: rachis winged: throughout Malaya, chiefly riverbanks	*G. bijuga*
Twigs, rachis and undersides of the leaflets more or less persistently silky hairy	
Leaflets 2–3 pairs, rather broad: rachis more or less winged: sandy beaches on the East coast and Singapore	*G. pleuropteris*
Leaflets 3–5 pairs, rather narrow: rachis not winged: inland	
Leaflets closely and finely silky beneath: Malacca, Johore and Singapore ..	*G. pubescens*
Leaflets sparsely hairy beneath: Perak, Penang and Kedah	*G. fuscidula*

G. bijuga

Buds silky: twigs, rachis and undersides of the leaves very soon glabrous, or very sparsely hairy.

Leaflets 1–2 pairs, 7.5–18 × 2.5–7 cm., elliptic, slightly acuminate, slightly curved, with 5–9 pairs of *lateral veins distinctly inarching short of the margin:* rachis narrowly to distinctly winged.

Inflorescence as in *G. pleuropteris* but laxer with fewer, longer, 4–6 mm. long, side-branches: outer sepals only slightly smaller than the others: petals as in *G. pleuropteris* but the scales nearly as long, or as long, as the petals and densely hairy (hairier than in *G. pleuropteris*) : disc widely open on one side.

Fruit as in *G. pleuropteris.*

Throughout Malaya, chiefly on riverbanks (? in belukar or coastal), perhaps the commonest species.

G. fuscidula

Twigs, rachis and inflorescence brown silky hairy (dry), but the twigs and rachis glabrescent when old: the undersides of the leaflets persistently but rather sparsely hairy.

Leaflets 2–4 pairs, 4–13 × 1.2–6.5 cm., lanceolate-elliptic, curved, with 5–9 pairs of *lateral veins distinctly inarching short of the margin:* rachis not winged.

Inflorescence as in *G. pleuropteris,* but lax: flowers slightly smaller the two outer sepals much smaller than the

others: petals much shorter than the sepals, their scales nearly twice as long as themselves: disc entire.

Fruit ca. 1.7 cm. long, glabrous.

Inland secondary forest, Perak, Penang and Kedah.

Some collections have rather wider leaflets than others and some have the undersides of the leaflets glabrous.

G. pleuropteris

Twigs, rachis and inflorescences finely silky hairy, the undersides of the leaflets more or less glabrescent.

Leaflets 2–3 (rarely 4) pairs, 4–18 × 2–6.5 cm., rather large, lanceolate-obovate, blunt or subacute, with 4–9 pairs of *lateral veins passing obliquely out to the very edge of the leaf,* very faintly inarching at the edge or not at all: *rachis narrowly to rather broadly winged.*

Inflorescence 5–13 cm. long, simple or with 1–3 branches, the lateral branches of the thyrsi crowded and 2–4 mm. long: the two outer sepals distinctly smaller than the others: petals as long as the sepals and with the scales about a ½–⅔ of their length: disc very narrowly notched or practically entire (especially in the bisexual flowers).

Fruit 2 cm. long.

Sandy beaches and heaths of the East coast from Singapore to Kelantan, not known from the West coast or inland much from the sea.

G. pubescens

Hairy as *G. pleuropteris* but the undersides of the leaflets persistently finely and closely silky hairy.

Leaflets 3–5 pairs, 6.5–13 × 2–4 cm., lanceolate-elliptic, curved, strongly asymmetric, the basiscopic side of the base strongly cut away, with 6–9 pairs of *lateral veins distinctly inarching short of the margin:* rachis not winged: leaflet-stalks rather long.

Inflorescence as in *G. pleuropteris;* the two outer sepals distinctly, but not much, smaller than the others: petals and scales as in *G. bijuga:* disc open on one side but not so widely as in *G. bijuga* occasionally entire in the bisexual flowers.

Fruit silky then glabrescent.

Common in inland belukar of Malacca, Johore and Singapore.

AMPELIDACEÆ

Leea gigantea Griff.

Notulæ IV, p. 697.

Whether this species occurs in Malaya is doubtful. Excepting a few sheets which belong to other species, all those identified as *L. gigantea* in the Singapore herbarium

are referable to *L. indica* (Burm. f.) Merrill [= *L. sambucina* (L) Willd.]. I am doubtful even if *L. gigantea* is specifically separable from *L. indica.*

RUBIACEÆ

Gardenia

G. tubifera Wall.

Roxb., Fl. Ind. ed. Wall. 2, *1824,* p. 562.
Synonyms:—
G. resinifera Korth., Ned. Kruidk. Arch. 2, p. 191.
G. speciosa Hook. f., F.B.I. 3, *1880,* p. 117=*Randia speciosa* Hook. Ic. Pl. *1852,* t. 824: haud *G. speciosa* Salisbury (*1796*).
G. elata Ridley, Journ. Roy. As. Soc. Str. Br. 79, *1918,* p. 81.
G. Lobbii Craib, Fl. Siam. En. 2, *1932,* p. 120.

I am unable to separate *G. tubifera, G. speciosa* and *G. elata* because there is so much variation in the plants that I cannot discover any natural dividing lines. Hooker distinguished *G. speciosa* from *G. tubifera* by its broader leaf, rounded at the tip and more abruptly narrowed at the base, its longer calyx and larger corolla. King followed Hooker but added that the calyx-tube of *G. tubifera* was sometimes split on one side, though truncate at the apex, while that of *G. speciosa* had an oblique mouth with a few irregular lobes. Ridley considered *G. tubifera* to be a bush, *G. speciosa, G. elata* and *G. resinifera* to be trees and separated them on differences in length of calyx and corolla and on whether the calyx was split or not: but the distinctions are very hard to follow.

I find that none of these characters are constant but are combined in various ways. In the first place, the leaves vary greatly in size, those on the flowering twigs being commonly much smaller than those on the vegetative shoots, with a tendency to anisophylly in the pairs, those on the upper or inner side of the twig being smaller. Hence, unless it is stated whether the measurements of the leaves cover those on flowering and sterile twigs, no characteristic can be attributed to them. In shape, petiole and venation the leaves of all three species are identical.

As regards the calyx-tube, the splitting on one side is variable. Entire and variously split tubes can be found on the same tree. This variation King has noticed in his three forms of *G. tubifera,* though I consider that his Form 2 is

worthy of varietal rank (*vide* infra, var. *subcarinata*). The variation was overlooked by Ridley.

As regards the size of the calyx and corolla, the following measurements show the gradation which renders any specific distinction on this ground impossible:—

	Calyx-tube	*Corolla-tube*	*Limb*	*Authority*
G. tubifera	1.3 cm.	4–7.5 cm.	2.5 cm.	Hooker
	4–4.5 cm. for the fruit!			
	1–1.7 cm.	4.5–6.4 cm.	5–6.4 cm.	King
	1.3 cm.	7.7 cm.	5.5 cm.	Ridley
	1.2 cm.	4–7.5 cm.	2.5 cm.	Koorders and Valeton
	.6, .7, .8, .9, 1, 1.1, 1.2, 1.4, 1.5, 1.7 cm.	3, 4, 6, 7, 11 cm.	3, 4, 6, 6.5	Corner (ex. Herb. Sing.)

Special collections:—

Carr 26547, Mt. Kinabalu: calyx-tube 1.4–1.7 cm.: corolla-tube 3–3.5 cm.

For. Dept. B.N.B. 3861: calyx-tube 1 cm.: corolla-tube 11 cm.

Corner 32440, Johore: calyx-tube 1.7–2.3 cm.: corolla-tube 8.5–10.2 cm.

Kiah 32368 Johore: calyx-tube 1.5–1.8 cm.

	Calyx-tube	*Corolla-tube*	*Limb*	*Authority*
G. speciosa ..	3.8 cm.	7.6–9 cm.	10.2 cm.	Hooker
	2–3.8 cm.	7.6–9 cm.	6.3–7.6 cm.	King
G. elata ..	2 cm.	7.6 cm.		Ridley
	2, 2.3, 2.6 cm.	7.5, 11.5, 14.5 cm.	7, 8 cm.	Corner (ex. Herb. Sing.)

It will be seen that the collections Corner 32440 and Kiah 32368 unite the three species and that Carr 26547 and For. Dept. B.N.B. 3861 confound them. That Hooker misunderstood these Gardenias is evident from the different measure he gave for the flowering and fruiting calyx of *G. tubifera:* the calyx-tube does not enlarge in the fruit. Clearly *G. tubifera* is very variable in size of the corolla and calyx, just as *Ixora javanica.* Whether the difference in size has any varietal value can be decided only after an extensive study of the species in the field, but I am inclined to think that it will not be found of much significance.

As for the supposition that *G. tubifera* is a bush and the other species are trees, it seems to reduce to a statement that as *G. tubifera* grows up it becomes another species. These Gardenias begin to flower at an early age and gradually they develop into medium-sized trees 15–20 m. high. *G. tubifera* is commonly a bush by riversides but a little further removed into the forest one finds it a small tree 5–10 m. high. The collection Corner 32440 was from a tree 8 m. high, and Kiah 32368 from a tree 15 m. high. Hooker described *G. speciosa* originally as a shrub. I would

mention the cases of *Xylopia fusca* and *Sloetia elongata*, big trees reaching 50 m. high, which begin to flower as 1 m. saplings.

As regards *G. elata* I can see no difference between it and *G. speciosa* Hook., nor has Ridley or Craib (for his *G. Lobbii*) indicated any contrast.

On the other hand I propose to distinguish King's Form 2 of *G. tubifera* as the following variety.

G. tubifera var. **subcarinata** var. nov.

Calycis tubo breviori, 6–9 mm. longo, *subcarinato-striato costis* 6–9 *longitudinalibus:* corollæ tubo 4–7.5 cm. longo, limbo 4–5 cm. lato: ovario breviori 3–4 mm. longo.

Collections:—

KEDAH: For. Dept. 7501, Ridley s.n. June 1893.
PENANG: Curtis 686 (*type*).
PAHANG: Burkill and Haniff, 17129.
PERAK: Wray 2522.
SELANGOR: For. Dept. 4753.
MALACCA: Alvins s.n. 23.3.86.
SINGAPORE: Ridley 2588, 4416, Goodenough s.n. 25.1.90.

All these collections are from inland forest trees. They represent what Ridley called *G. resinifera* (Fl. Mal. Pen. 2, p. 82). The distinctive feature is the short, ribbed calyx-tube. The amount of resin on the twigs varies greatly in the whole species and cannot be estimated from herbarium specimens because it is more or less removed by alcohol.

It may be observed, in conclusion, that *G. coronaria* Ham differs from *G. tubifera* in its pedicellate ovary, oblong fruit and 5 petals. *G. Griffithii* differs from *G. tubifera* in its almost sessile leaves (the petiole being winged almost to the base), its much longer calyx-tube 5–7.5 cm. long which clothes the corolla-tube for more than half its length like a stocking, and the 8–12 petalled limb (6–10 in *G. tubifera*, mostly 8–9).

Pavetta

P. indica L. Sp. Pl. p. 110.

Synonyms:—

Pavetta pauciflora Ridley, Fl. Mal. Pen. 2, *1923*, p. 101.

Tarenna salicina Ridley, Journ. F.M.S. Mus. 4, *1911*, p. 34.

I follow King, in the 'Materials', in regarding *P. graciliflora*, *P. tomentosa* and var. *canescens* as forms only of *P. indica*. I find it impossible to regard them even as satisfactory varieties, not because the extreme states are not decidedly different but because there is every intermediate condition from plants with glabrous leaves to those

with velvety leaves. In flower, fruit and inflorescence there is, also, no decided difference. If the extreme states are to be classified, what are we to do with the intermediates? It is these intermediates which are overlooked that seem to me most important. I think the species can be subdivided only after intensive ecological and horticultural study. It seems not to be realised, for instance, that Terminalia-branching is typical of *P. indica*, whereby laterals are projected beyond the 'range' of the parent shoot through the elongation of the first internode. Such laterals at the ends of the main branches generally bear the flowers so that the having of inflorescences projected laterally on "long peduncles" is not characteristic solely of *P. graciliflora*. I find, moreover, Craib's subdivision of Pavetta so intricate and impracticable that it seems impossible to identify any Pavetta unless one can compare it simultaneously with specimens he has determined. Koorders and Valeton also interpret *P. indica* in the widest sense (Bijdr. Booms. Java. 8).

As regards *P. pauciflora* and *T. salicina*, specimens of the type-collections are in the Singapore Herbarium. They are both what Ridley has also determined as *P. graciliflora*, that is the glabrous state of *P. indica* with 'long pedunculate' inflorescences. The tetramerous flower of the Tarenna Ridley himself described: there are also bacterial nodules on the leaves.

P. naucleiflora Don

Gen. Syst. 3, *1834*, p. 575.

Synonyms:—

Tarenna Napieri Ridley (= *Webera Napieri* Ridley), Journ. F.M.S. Mus. 4, *1911*, p. 34.

Rutidea mollis Bl. *vide* Bremekamp, Blumea Suppl. 1, *1937*, p. 112.

Specimens of the two syntypes of *T. Napieri* are in the Singapore Herbarium, namely Napier (Bukit Tangga, pr. Seremban) and Ridley (Telom). They are identical with *P. naucleiflora*, having the tetramerous flowers in small dense clusters, the hispid pedicels and calyces, the laxly reticulate venation and the bacterial nodules. Ridley himself described the tetramerous flower which excludes the species from Tarenna. As described and cited in the Fl. Mal. Pen. vol. II, *T. Napieri* includes also *Stylocoryne mollis*.

I doubt if *Pavetta pilosa* Craib (Kew Bull. *1932*, p. 433) is really distinct but I have not seen the type. Similarly with *P. Wallichiana* which Craib has resurrected (Fl. Siam. Enum. 2, p. 171).

Randia

R. densiflora Benth.

Fl. Hongk. *1861*, p. 155.

This is another common and variable species which is in need of a critical study from living specimens. The flowers may be sessile or distinctly pedicelled, glabrous or very hairy: the calyx varies in size in different collections from 2–5 mm. long and the style projects from 6–10 mm.

Merrill has recently proposed the name *R. cochinchinensis* (Lour.) for the species on the grounds that it is *Aidia cochinchinensis* Lour. (Comm. Lour. Fl. Cochinch. *1935*, p. 365). But I find that the evidence is far from satisfactory. There is a fragmentary specimen of Loureiro's Aidia at the British Museum which S. Moore identified as a Randia, possibly *R. eucodon* K. Schum. but, the specimen lacking flowers, it was impossible to be certain (Journ. Bot. *1925*, p. 250). Merrill has rejected Moore's identification without publishing his reason. If one reads Loureiro's description, one finds that Aidia should have "Filamenta nulla ..... Bacca... 1-sperma" and that *A. cochinchinensis* should be "Arbor magna" and should have "racemis laxis." How then can 'Aidia ex descriptione' be Randia? It may be remarked that Chevalier and Merrill first identified *A. cochinchinensis* with *Fagraea fragrans* (Loganiaceae). This difficulty was overcome by supposing that Loureiro mistakenly attributed the local name and wood-characters of the Fagraea to the specimens of Randia which he described. But, I would ask, might not Loureiro mistakenly have given the name *Aidia cochinchinensis* to the specimens of Randia which he dried? When such doubt prevails, the species should be dismissed as a *nomen dubium*. *Randia densiflora* has a dense cyme, obvious filaments, and a many-seeded berry: in no way can it be called a big tree. It is certainly not *Aidia cochinchinensis*.

R. spinosa (Thunb.) Poir

Lam. Encycl. Suppl. 2, *1812*, p. 829.

Syn. *R. dumetorum* Poir, loc. cit.

R. oocarpa Ridley, Journ. Str. Br. R. As. Soc. 79, *1918*, p. 79.

Ridley states that *R. oocarpa* of Malaya differs from *R. dumetorum* of India in having thinner, larger leaves, smaller flowers, more lax habit and small and scantier thorns, but I do not see how any of these points are to be confirmed. The spines of the Malayan plants vary from .1–10 cm. long, being longest on the main stem and smallest on the twigs from which they are often absent. In the character of the leaves I find no difference between the

description of the Indian and Indo-Chinese plants and that of Ridley's. The habit is too variable and little known to be used as a specific character. But it does seem that the petals of the plants from Malaya and Lower Siam are smaller than those from India and Indo-China, but this point needs confirmation from many more collections. Ridley did not give the size of the corolla. Hence I conclude that *R. oocarpa* can, at most, be a small flowered variety of *R. spinosa* with which it agrees in vegetative and floral construction, including such details as the veins of the leaf, the shape of the sepals, and the size and colour of the fruit.

The synonymy of the species is given in part by Merrill (Comm. Lour. Fl. Cochinch. p. 367).

Tarenna

T. Napieri Ridley = *Pavetta naucleiflora* Don
T. papillosa Ridley = *T. appressa* (King) Corner
T. rudis Ridley = *T. longifolia* (Don) Ridley
T. lancifolia Ridley = *T. appressa* (King) Corner
T. salicina Ridley = *Pavetta indica* L. (or *P. graciliflora*)

The distinction between Stylocoryna and Tarenna rests with the 2-multiovulate loculi of the first and the 1–2 ovulate loculi of the second. In both the flower is pentamerous and fragrant (? always): in Pavetta the corolla is white, but in Tarenna it is white, yellow or green. Ridley adds that the style is long in Stylocoryna and short in Tarenna, but I do not see that this character is at all acceptable without stating the ratio of length of style to length of corolla-tube. The species of Stylocoryna are nearer to those of Tarenna than to any other genus of Rubiaceae and, the ovular-criterion being imperfect, I prefer to unite the two genera. *T. appressa* (*Stylocoryna appressa* King) is exactly intermediate having 2–4 ovules in each loculus. That the grouping of Rubiaceous genera according to the number of ovules in the loculi is artificial, just as in the Euphorbiaceæ, is shown by these two genera.

The status of Ridley's species, which I have given as synonyms, are discussed under the species to which I have referred them.

T. appressa (King) Corner nov. comb.

Basinym:—

Stylocoryne appressa King, Mat. Fl. Mal. Pen. 4, *1903*, p. 90.

Synonym:—

S. appressa var. *papillulosa* King, loc. cit.

Tarenna papillosa Ridley, Fl. Mal. Pen. II, *1923*, p. 103 (= a misnomer for *S. appressa* var. *papillulosa* King).

Tarenna lancifolia Ridley, Fl. Mal. Pen. V, *1925,* p. 316.

This species is so variable in the hairiness of the underside of the leaf that I cannot distinguish King's variety with satisfaction. The texture of the leaf varies from membranous to subcoriaceous, the pairs of side-veins from 6–9 to 10–12, and the corolla-tube varies from .7–1.3 cm. long.

Ridley distinguishes Stylocoryne from Tarenna by the long style and 2-many seeded ovarian loculi of the former. Therefore *T. papillosa* must be Stylocoryne because it has the style projecting 7–8 mm. from the corolla and it has 2–4 ovules in each loculus. But, as I have said, the distinction between the two genera being unsatisfactory, I prefer to unite them.

Both syntypes of *T. lancifolia* are in the Singapore Herbarium, namely Burkill 8686 and Haniff 4954. They are identical with King's species. Ridley's statement that the fruit of *T. lancifolia* has "2, flattened, rounded" seeds probably refers to the clump of half-developed seeds in each loculus of the immature fruit.

T. appressa is well-characterised by its lanceolate leaves more or less pubescent beneath, small tooth-like sepals, and white, fragrant corolla with green tips to the petals. It is rather common in the Malayan forest.

T. longifolia (Don) Ridley

Fl. Mal. Pen. 2, *1923,* p. 104.

Basinym:—

Ixora longifolia Don, Gen. Syst. 3, *1834,* p. 573.

Synonyms:—

Webera grandifolia Hook. f., F.B.I. 3, *1880,* p. 105.

Tarenna grandifolia (Hook.) Ridley, loc. cit.

Tarenna rudis Ridley, loc. cit. p. 103.

? *Tarenna sumatrana* (Bœrl.) Ridley, Kew Bull. *1926,* p. 69.

Webera sumatrana Bœrl.

Tarenna hispidula Craib, Fl. Siam En. 2, *1932,* p. 91.: var. *brevipes* Craib, var. *Smithiae* Craib, loc. cit.

Hooker distinguished *W. grandifolia* from *W. longifolia* by its rather broader leaves having glabrous undersides with only 12–15 pairs of nerves (*W. longifolia* having the leaves softly tomentose beneath and 16–30 pairs of nerves). To these differences King added that the sepals were short blunt teeth in *W. grandifolia* and deeply linear lobes as long as the receptacle in *W. longifolia* (Mat. Fl. Mal. Pen. 4, *1904,* p. 139). Ridley added that *T. longifolia* had a pendulous corymb and *T. grandifolia* an erect one.

After studying the specimens in the Singapore Herbarium I conclude that these distinctions are not constant because they are displayed in various combinations and intermediates and that Ridley's distinction concerning the corymb is wrong because it is not merely pendulous but vertically deflexed from the base of the peduncle in both species. I find that *W. grandifolia* as understood by King generally has leaves glabrous on both sides, nerves 10–20 pairs, sepals 1–1.5 mm. long, corolla-tube 5–7 mm. long and petals 6–8 mm. long: that *W. longifolia* has the leaves glabrous above and softly tomentose beneath, nerves 16–27 pairs, sepals 1.5–2.5 mm. long, corolla-tube 8–10, 9–11, or 11–13 mm. long, and petals 4–6 mm. long.

But, several collections agreeing with *W. longifolia* have the leaves hairy on the upperside as well, and others have them only very slightly hairy on the underside. The collection, Ridley 14315, has the sepals and corolla of *W. longifolia* and the glabrous leaves of *W. grandifolia*. The collections, Wray 2081 and Scortechini 228, have the sepals of *W. longifolia*, the venation of *W. grandifolia* and the blade sparsely adpressedly hairy on the underside.

The collection, Kloss 14810 (Sumatra), referred by Ridley to *Tarenna sumatrana*, has the corolla-tube 10 mm. long, the petals 6–7 mm. long, the sepals 1–1.5 mm. long and the leaves sparsely and minutely hispid beneath. It combines, that is, the apparent floral differences between *T. grandifolia* and *T. longifolia*.

Tarenna hispidula Craib has the leaves and venation of *T. grandifolia* (but the leaves are sparsely puberulous beneath), the corolla of *T. longifolia* and the sepals intermediate. Craib's two varieties, based on a single collection each, would make a good precedent for describing a new variety from every collection.

As I can find no constant difference of specific value between *T. longifolia* and *T. grandifolia*, I reduce the latter to the former. If it seems that every gap between them has not been bridged, future collections will certainly supply the defect. That the species has not been understood is evident because the characteristic deflexed posture of the inflorescence has not been recognised. The large, cuspidate, many-veined leaves, the white fragrant flowers and the deflexed peduncle make the species as characteristic in Tarenna as *I. pendula* in Ixora.

A specimen of one of the syntypes of *T. rudis*, namely Foxworthy 2952 (misquoted 2592 by Ridley), is in the Singapore Herbarium. It is identical with *T. longifolia*. The identity was doubtless overlooked by Ridley because he placed *T. longifolia* in the wrong section of his key.

Timonius

T. compressicaulis (Miq.) Boerl.
Handl. II, 1, *1891*, p. 133.
Basinym:—
Polyphragmon compressicaule Miq., Fl. Ind. Bat. 2, *1857*, p. 235.
Synonym:—
T. Finlaysonianus Hook. f., F.B.I. 3, *1880*, p. 127.
T. jambosella var. *Finlaysoniana* King, Mat. Fl. Mal. Pen. 4, *1904*, p. 128.

That *T. Finlaysonianus* is a synonym of *T. compressicaulis* I am certain from the detailed description of *T. compressicaulis* given by Valeton (Bull. Dep. Agr. Ned. Ind. 26, *1909*, p. 54) and from the fact that a specimen of the collection Achmad 23 (Simalœr Island, pr. Sumatra) in the Singapore Herbarium and so determined by J. J. Smith is identical with the Malayan species. As Valeton remarked, the compressed stem, glabrous obovate leaves, rather large silky stipules, the 4-5-merous male corolla, the 6-7-merous female corolla and the 14 loculi of the fruit render the species most distinctive. It is rather common on the rocky and sandy shores of Malayan islands and, doubtless, occurs on most others in the Rhio Archipelago as well as on those near Sumatra.

T. flavescens (Jack) Baker
Fl. Mauritius, *1877*, p. 144.
Basinym:—
Helospora flavescens Jack, Tr. Linn. Soc. 14, *1823*, p. 127, t. 4, f. 3.
Synonym:—
T. peduncularis Ridley, Fl. Mal. Pen. 2, *1923*, p. 113.

As Valeton has shown, there is no doubt of the interpretation of Jack's species which is one of the commonest in W. Malaysia (Bull. Dep. Agr. Ned. Ind. 26, *1904*, p. 34). Ridley's name, based on the *nomen nudum Guettarda peduncularis* of Wallich's Catalogue, is thus untenable.

Vangueria

V. spinosa var. **mollis** Hook. F.B.I. 3, p. 136.

I have found this variety of the well-known *V. spinosa* rather common in open ground and secondary jungle in the neighbourhood of Kota Bahru, Kelantan. Hence it must be admitted to the Malayan flora, but whether it is truly a native of the forest has to be discovered.

In general appearance this Vangueria bears an extraordinary resemblance to the thorny *Randia spinosa* so that one must examine sterile plants carefully to distinguish them.

Gardens Bulletin, S.S.

According to Robyns, the Kelantan plants should be *Meyna pubescens* (Bull. Jard. Bot. Brux. II, *1928*, p. 235). But I am unable to follow this author in his treatment of the genera and species. Hooker, King, Pitard, Koorders and Valeton have regarded *V. spinosa* as a variable species. Robyns has made the varieties into species and distinguished them under the genus Meyna, but in his key to the species I do not find that any character of decided morphological value has been employed.

The species of Meyna are placed in two groups whether hairy or glabrous, though pubescence is one of the most variable and unspecific characters of tropical dicotyledons, above all these Rubiaceæ. I have no doubt that field-botanists will find such splitting of *V. spinosa* quite impracticable.

Meyna is said to differ from Vangueria in the presence of thorns, the dwarf flowering shoots and the generally sessile clusters of flowers, the inflorescences of Vangueria being pedunculate cymes. If genera are to be separated on such grounds, then away go Randia, Canthium, Psychotria, Lasianthus, Timonius, Urophyllum, Hedyotis and Argostemma, to mention but a few. The old, easily recognisable genera are bereft of their usefulness and in their place stand congeries of artificial entities.

NOTES ON THE SYSTEMATY AND DISTRIBUTION OF MALAYAN PHANEROGAMS, II

The Jack and the Chempedak

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Introduction

Throughout the Malayan region, from Sumatra to New Guinea, there are two common village-trees that are called in Malay "nangka" and "chempedak". The first is better known as the Jack (from its Indian name "jaka"): for the other we must at present borrow from the Malay because there is no alternative. In Malaya we have also a wild form of Chempedak that is scattered in the high forest throughout the mainland from the lowlands to an altitude of 4,000 ft.: it is called "bangkong" or, in Johore, "barok" but only the first is well-known and that only in the middle of the country. I shall refer to it as the Wild Chempedak. Now I use these vernacular names purposely because, until these pages have been read, I do not see how anyone, be he botanist or not, European or Asiatic, can know what are the specific differences between the plants or what may be their botanical names. The best recent descriptions of them are those given by Bakhuizen van den Brink in Ochse's two books.* There are, however, about two dozen distinctions most of which have not been described and it

* Fruits and Fruit-Culture in the Dutch East Indies, *1931*, p. 67. Vegetables of the Dutch East Indies, *1931*, p. 486.

appears that a post-Linnean study of the Chempedak-fruit has never been made, leastways not published: indeed, for what one may read about it in botanical literature, the Chempedak may be likened to a Dodo. The most informative and authoritative descriptions are those on the "Nanka" and "Tsjampedaha" written by Rumphius in 1690 though not published until 1750 (Herb. Amboin. tom. I.) and that on the "Tsjakamaram" published by Governor Rheede in 1682 (Hort. Malab., III), though, being pre-Linnean, one would assign to them only a historical value. As for the Wild Chempedak, what is yet written concerning it is little more than the record. Since I began this investigation, however, I have been fortunate in finding a fruiting tree in the East of Johore, several such trees by the Tahan River in Pahang and one flowering and many sterile trees on Fraser's Hill, Pahang. I have thus been able to study the Wild Chempedak critically.

In the first part of this paper I have compared these plants as fully as possible and, in the second part, I have argued what must be their correct botanical names. As the results are somewhat momentous and I have no doubt that what I have discovered will not be acceptable to many, I have investigated the problem with the greatest care. For nearly 150 years the Jack has been called *Artocarpus integrifolia* Linn. f. but the name was changed recently to *A. integra* (Thunb.) Merrill without any reason. In checking the alteration, I found that the original descriptions of both names referred to the Chempedak and I can now add that the type-specimen of both is the Chempedak. The name *A. integra* or, correctly, *A. integer* which has been used in error for the Jack must now be given to the Chempedak and for the Jack one must resuscitate its earliest legitimate synonym which is *A. heterophylla* Lam. or, correctly, *A. heterophyllus*. It is evident that not merely has the botany of these common plants been neglected but no systematist has ever referred critically to the original description of *A. integer* or *A. integrifolia* and the type of both names has never been re-examined: oranges and lemons, as it were, have been confounded. For the Wild Chempedak I have made the new variety *A. integer* var. *silvestris*.

Acknowledgements

It has been through the goodness of Professor N. E. Svedelius, of the Botanical Institution of Uppsala, that I have been able to conclude this investigation, and I wish to record my sincere thanks for his assistance. Professor Svedelius discovered the type of *Rademachia integra* Thunbg. (the basinym of *A. integer* and *A. integrifolia*)

and compared with it specimens of Jack and Chempedak which I sent. The extent to which I am indebted to Prof. Svedelius can be seen from the extracts of his letters which he has allowed me to publish, as well as from the photographs of the type-specimen which he has supplied.

I also express my gratitude to Mr. J. W. Grant, Rice Research Officer in Burma, for his assistance in sending specimens of Jack from Burma; to the Deputy Director of Agriculture, Tenasserim Circle, Moulmein, and the Senior Agricultural Assistant, Mudon, Burma, for specimens of 'Sone-ka-dat' (Chempedak); to Mr. R. C. Broadfoot, Principal of the Agricultural College, Coimbatore, for specimens of Jack from Coimbatore; to Mr. G. Taylor, of the British Museum, for kindly enquiring into the original specimens of Loureiro's species of Polyphemia and for copies of descriptions not available in Singapore; and to Mr. C. X. Furtado, of the Singapore Botanic Gardens, for his guidance in the Rules of Botanical Nomenclature.

PART I, DESCRIPTION

Characters common to the Jack, Chempedak and Wild Chempedak

Large evergreen trees with dense, dark green, spreading crowns: *trunk* not or scarcely buttressed: *bark* greyish brown, dark, rough, uneven, somewhat scaly: *inner bark*, thick, ochraceous: *latex* white, copious, gummy: *wood* yellow: *young leaves* pale yellowish green: *sapling leaves* with 1–2 pairs of lobes.

Leaves alternate on the horizontal branches, spirally arranged on the ascending branches: *blade* 4–25 × 2–11.5 cm., thinly leathery, entire, tending to point upward and to have upcurled sides, base cuneate: *lateral veins* 5–12 pairs, arising at a wide angle and curving forward: reticulations minute: *petioles* 1–4 cm., long: *stipules* .7–8.5 cm. long.

Inflorescences cauliflorous and ramiflorous, on short leafy twigs, male and female on the same tree, the female at the base of the short twigs, the males from the subsequent leaf-axils: *male inflorescences* occasionally axillary on the ordinary twigs: pedunculate, hanging, with oblong, blunt heads; without bracts between the flowers.

Male flowers with a minute, tubular perianth with 2 lobed mouth: 1 stamen: fragrant.

Female flowers tubular, connate except at the base and apex, the apical part projecting as a 3–7–gonous, blunt or acute cone or pyramid traversed by the style.

Syncarps very large with copious pulp round the large "seeds": hanging from short, stout woody twigs on the

trunk and branches, solitary: the apex of the stalk more or less sunk into the head.

Seeds with more or less unequal cotyledons: varying 2–3.3 cm. long × 1.1–2.3 cm. wide: germination 'subepigeal', with very short hypocotyl and long epicotyl bearing several scale-leaves before the first foliage-leaves, the cotyledons spreading at soil-level and turning deep green.

Distinctions between the Jack, Chempedak and Wild Chempedak

(living plants)

1. Hairiness

Jack.—All parts glabrous or with minute, white hairs up to .5 mm. long, the tips breaking off and the bases giving the slight scabrid feel to the leaves and twigs.

Chempedak.—Leaf twigs, petioles, stipules, the veins on the underside of the leaf and the stalks of the flower- and fruit-heads, set with long, wiry, spreading, pale to dark brown hairs, 1–7 mm. long: the male flower-heads occasionally with glabrous stalks. (It is possible that there are glabrous varieties of Chempedak in India, *vide infra* "Varieties of Jack").

Wild Chempedak.—Varying (in different collections) from wholly glabrous like the Jack to hairy like the Chempedak.

Concerning the variability of the Wild Chempedak it is impossible, at present, to say whether there are glabrous, hairy and slightly hairy varieties or that these states merely indicate stages in the development of individuals, the oldest or biggest being glabrous. I am inclined to think that differences may be of both kinds for seedlings of a Wild Chempedak (S. F. No. 32988) that I raised had rather thickly set, short white hairs, though the parent tree was glabrous.

2. Colour of Leaf-Blade

Jack.—Very dark shiny green, or blackish green, on the upperside; the midrib and main veins greenish white to pale greenish yellow: old leaves withering orange-ochre to brown-ochre.

Chempedak.—Rather dull middle-green, or even slightly yellowish especially on the underside, much paler than the Jack: the midrib pale greenish yellow to greenish ochre: withering as the Jack.

Wild Chempedak.—As the Chempedak but the midrib distinctly ochre on both sides, commonly ochre-brown on the underside: withering green or slightly yellowish green

or dingy yellowish, then turning dry and brown, never rich ochre or orange.

From the colour of the leaf, one can distinguish the Jack from the Chempedak at a distance. The absence of "autumn tints" in the Wild Chempedak is curious: I have checked it from many trees.

3. Shape of Leaf-Blade

Jack.—Elliptic-obovate to obovate, shortly and bluntly sub-acuminate: base tapered cuneate and decurrent on the petiole (Text-Fig. 1).

Chempedak.—Elliptic to narrowly elliptic-obovate, distinctly acuminate: base cuneate, abrupt, not decurrent (Text-Fig. 1).

Wild Chempedak.—Narrowly elliptic, otherwise as the Chempedak.

The character of the leaf-base enables one to distinguish at once between the dried leaves of Jack and Chempedak.

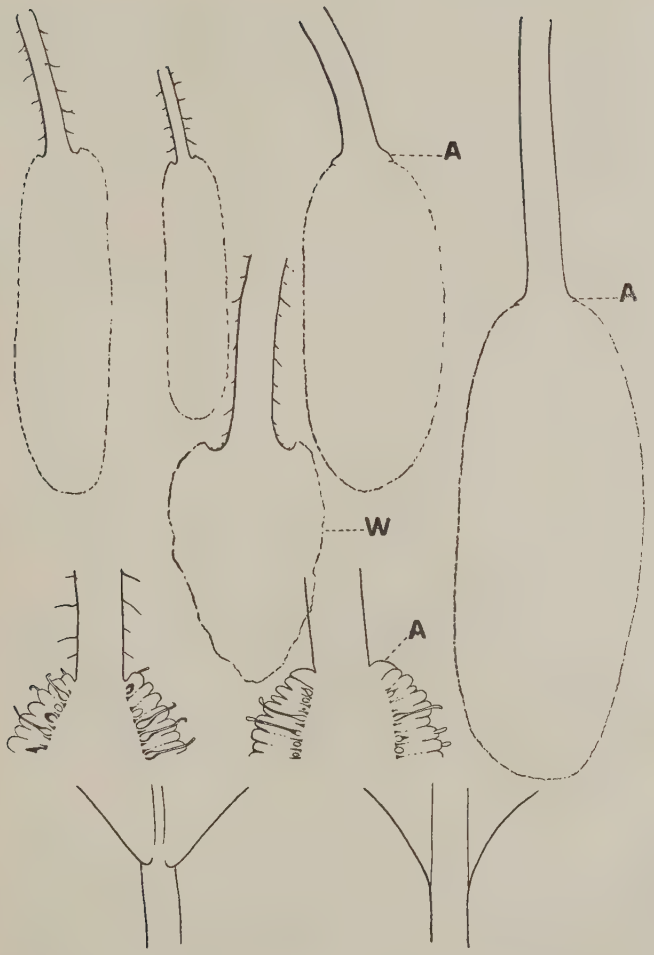
4. Male Inflorescences

Jack.—Peduncles stout, 1½–5 cm. long, 4–5 mm. wide: head ellipsoid, dark green, 3–7 cm. long × 2–2.8 cm. wide, with a dark green annulus, 1½–2½ mm. broad, at the base. Flowers smelling of honey and bananas: perianth 1–1.5 mm. high, slightly hairy: stamen 1.5–2 mm. high. (Text-Figs. 1, 2).

Chempedak.—Peduncles slender, 2–3 mm. wide, often verruculose: head cylindric, smaller, pale green to yellowish, 3–5.3 × .9–1.2 cm., with a minute furrow at the base but no annulus: flowers smelling of honey and burnt-sugar, stronger, toffee-like: perianth smaller and densely hairy, .7–1 mm. high: stamen smaller and slenderer, 1–1.3 mm. long. (Text-Figs. 1, 2).

Wild Chempedak.—Peduncles 4–6 mm. wide, stout, dilated at the apex: head conical with a broad furrow at the base (but no annulus), the apex blunt, the surface rugose, 3–4.5 × 2–2.5 cm., light green, very faintly honey-sweet: perianth 1–1.5 mm. high: stamen 1.7–2.4 mm. long (Text-Fig. 1).

The shape of the male inflorescence in the Wild Chempedak seems to be distinctive but I have seen only five inflorescences, two fresh and three nearly rotten, from one tree on Fraser's Hill. The difference from the cultivated Chempedak is surprising and shows how dangerous it is to extrapolate to other features from a partial similarity when studying tropical plants.



TEXT-FIG. 1.

Jack (to the right) and **Chempedak** (to the left): nat. size. Longitudinal sections of the male inflorescences and of the base of the female inflorescences at anthesis: *below*, the upperside of the junction of lamina and petiole: A, the annulus of the **Jack**: W, the male inflorescence of the **Wild Chempedak** in longitudinal section (S. F. No. 33205).

5. Female Inflorescences

Jack.—Peduncles stout, 8–9 mm. wide: heads ellipsoid dark green, with a stout green annulus, 3–4.5 mm. wide, at the base: style with the projecting apex spathulate or ligulate, slightly curved. (Text-Fig. 2).

Chempedak.—Peduncles not so wide, 6–7 mm.: heads cylindric, light yellowish green, with a slight furrow at the base but no annulus: style with the projecting apex filiform and often coiled. (Text-Fig. 2).

Wild Chempedak.—? As the Chempedak. (not known).

Both Jack and Chempedak seem to be insect-pollinated in contrast with the Bread-fruit tree, the Tĕrap (*A. elasticus*), and the Monkey-Jack (*A. rigidus*) which appear to be wind-pollinated, their male inflorescences emitting clouds of pollen when tapped or swung.

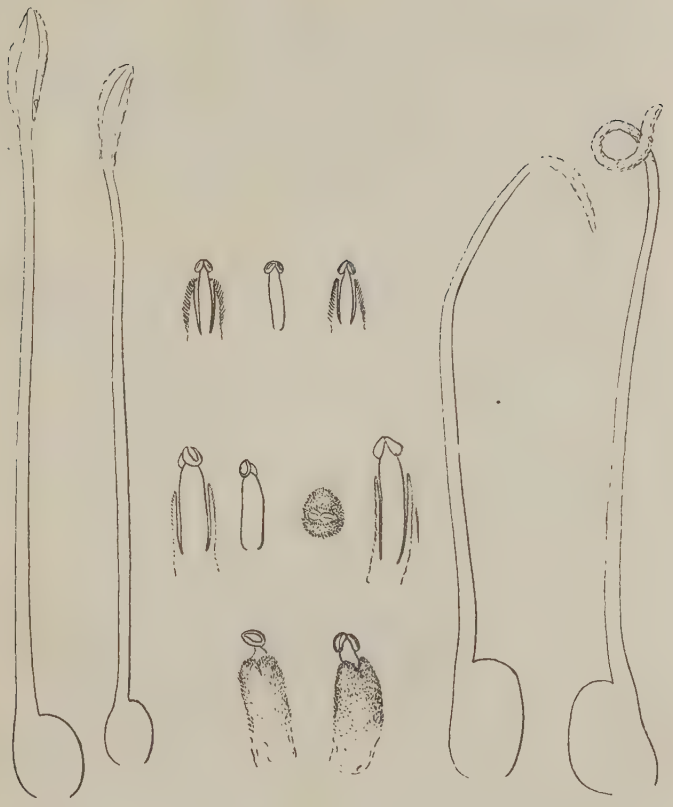
The morphological nature of the annulus I have not been able to discover. It is most characteristic of the Jack, its homologue in the Chempedak being a few minute hairy scales just above (proximal from) the lowest flowers on the head. The scales may be interpreted as bracts or as sterile flowers, their structure being too rudimentary to decide. The annulus of the Jack is a glabrous, tumid ring with a very narrow, abrupt flange along the edge: it does not cover the head of flowers at any stage or even attempt to. The presence of the annulus places Lamarck's species *A. heterophylla* beyond question.

It should be remarked that the Jack produces its female heads mostly from the trunk and bases of the limbs whereas the Chempedak fruits more often on the limbs than on the trunk. Indian botanists have suggested that the Jack tends to be ramiflorous at first and to become cauliflorous with age, but in Malaya that is by no means necessarily the case. It is possible that two species are confused in India (*see* p. 77).

The Wild Chempedak is variable. The trees which I saw along the Tahan River in Pahang, seven in all, bore their fruits in bunches on the trunk, from a height of one foot above ground, and along the stouter parts of the main limbs, but a very big tree (130 ft. high) in the East of Johore had its fruits only on the branches without a trace of a cauline twig. I think the Wild Chempedak is, therefore, cauliflorous at first, becoming ramiflorous in old age.

6. Size, Shape, Colour and Smell of Ripe Syncarp (False Fruit, or Fruit-head)

Jack.—30–90 cm. long × 25–50 cm. wide, oblong ellipsoid to pyriform, cream to golden yellow, *with a sickly sweet smell* like ripe bananas, rather strong or faint.



TEXT-FIG. 2.

Flowers of the **Jack** and **Chempedak** at anthesis, x 10: *left,* 2 female flowers of the **Jack:** *right,* 2 female flowers of the **Chempedak:** *upper centre,* 2 male flowers (with the perianth cut open) and a stamen, of the **Chempedak:** *lower centre,* male flowers of the **Jack,** 2 with the perianth cut open, one in end-view and just opening.

Chempedak.—20–35 × 10–15 cm., oblong cylindric, often like a badly-stuffed stocking, cream yellow to ochre or brownish ochre, *with a strong, harsh, penetrating stench* (like durian and bachang, *Mangifera foetida*).

Wild Chempedak.—15–30 × 10–15.5 cm., oblong elliptic, often uneven, golden then light orange-ochre to orange brown, or golden brown, *without any smell.*

The absence of smell from the Wild Chempedak is curious. I have checked it in eight trees and the observation was confirmed by Malays who were well-acquainted with the 'Bangkong' in Pahang and whom I questioned purposely. The cultivated Chempedak has, perhaps, the strongest and richest smell of any fruit in creation.

7. Wall and Core of Ripe Syncarp

Jack.—Wall and core firmly attached to the "seeds" (mericarps, or true fruits), the "seeds" having to be cut out: spines conspicuous, 4–10 mm. long, pointed or blunt (according to the variety).

Chempedak.—Wall and core easily separable from the "seeds", parting of their own accord, the "seeds" falling out on cutting open the syncarp: spines slightly prominent, 2–4 mm. long, pointed.

Wild Chempedak.—As the Chempedak but the spines distinctly prominent, 3–5 mm. long, or not (2–3 mm. long).

The separation of the wall and core in the Chempedak gives the fruit its baggy appearance.

8. Edible Pulp of "Seeds" (Fruiting perianth)

Jack.—Waxy-firm, translucent, rather cartilaginous, golden yellow, thickened below the seed to form a stout stalk, giving the "seed" an oblong shape: with a sweet, sickly taste like sugared banana. (Text-Fig. 3).

Chempedak.—Creamy-custardy, easily squashed, opaque, cream to golden yellow, not thickened to form a stalk, the "seed" appearing short and dumpy: with a strong, sweet taste of durian and mango. (Text-Fig. 4).

Wild Chempedak.—As the Chempedak but with merely a slight sour-sweet taste and no smell.

The insipid pulp of the Wild Chempedak is known to Malays whose sole use for the fruit is to extract, boil and eat the seeds as they do those of the Jack. It is the stalk to the pulp of the Jack-seed that makes it longer than the Chempedak-seed. The firm pulp of the Jack-seed, with its patent lumen, is shown in Gaertner's figure of 1791.

9. "Seed" (True fruit, inside the fruiting perianth)

Jack.—Pericarp as a thick (1 mm.) subgelatinous pellicle, or jacket, round the true seed, attached by its whole base: persistent style string-like, .5 mm. wide, from the distal third of the pericarp. (Text-Fig. 3).

Chempedak.—Pericarp as a transparent membrane (.1 mm. thick), attached at one side of the base: persistent style thread-like, from the proximal third of the pericarp. (Text-Fig. 4).

Wild Chempedak.—As the Chempedak.

The presence of a "jacket" round the Jack-seed and its absence from the Chempedak are well-known to natives. The persistent style is so slender in the Chempedak and its wild variety that it can easily be overlooked. The position of the style is shown correctly in Gaertner's figure of the Jack.

10. SEED-PROPER (matured ovule)

Jack.—Mango-shaped, generally distinctly flattened in a plane parallel with the sagittal (*i.e.* the longitudinal plane through the hilum): the hilum and micropyle in the distal third (near the radicular end of the seed): testa pallid white, rather thick, tough, parchment like, crinkly when dry: inner seed-coat as a thin brownish membrane, thickened at the hilum.

Chempedak.—Plump, scarcely flattened: hilum and micropyle in the proximal third (near the end away from the radicle): testa very thin, as a brownish membrane: inner seed-coat indistinguishable.

Wild Chempedak.—As the Chempedak, but the seed in some cases subcylindric. (Text-Fig. 5).

The tough testa of the Jack-seed is well-known to natives from the crinkling sound that it makes when the dry seed is rubbed between the fingers as well as from its power of protecting the dried Jack-seed. If the testa is intact the Jack-seeds will retain their power of germination for several months. The seeds of the Chempedak, with their membranous testa, have scarcely any power of dormancy and this difference doubtless explains why the Jack is far more widely distributed than the Chempedak. The seeds of the Wild Chempedak germinate in the fallen fruit before it is decayed.

11. EMBRYO (Kernel)

Jack.—With very unequal cotyledons, the one only 1/3–½ the length of the other: radicle superficial (the basal lobe of the smaller cotyledon being undeveloped). (Text-Fig. 3).

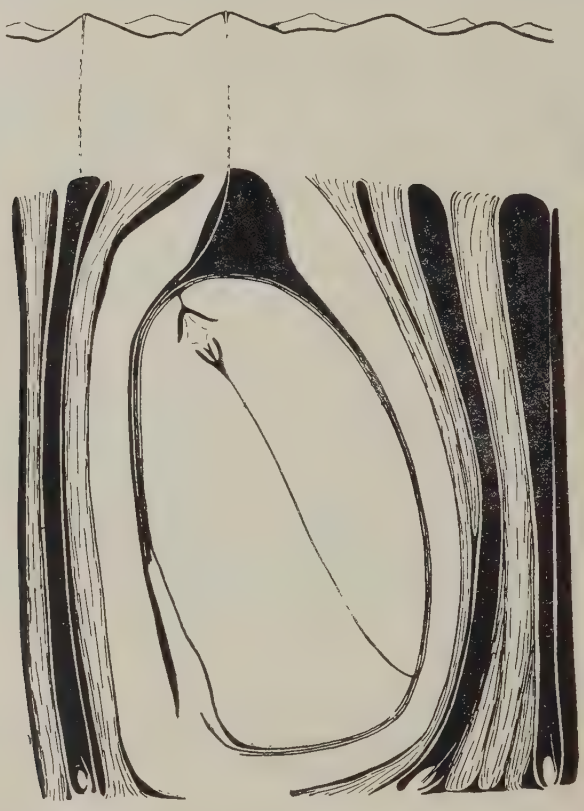
The Jack seems to have the most unequal cotyledons of any species of Artocarpus.

Chempedak.—Cotyledons less unequal, the one 2/3–3/4 the length of the other: radicle immersed (both cotyledons having basal lobes). (Text-Fig. 4).

Wild Chempedak.—As the Chempedak but the cotyledons often nearly equal. (Text-Fig. 5).

Conclusion concerning the Jack, the Chempedak and the Wild Chempedak

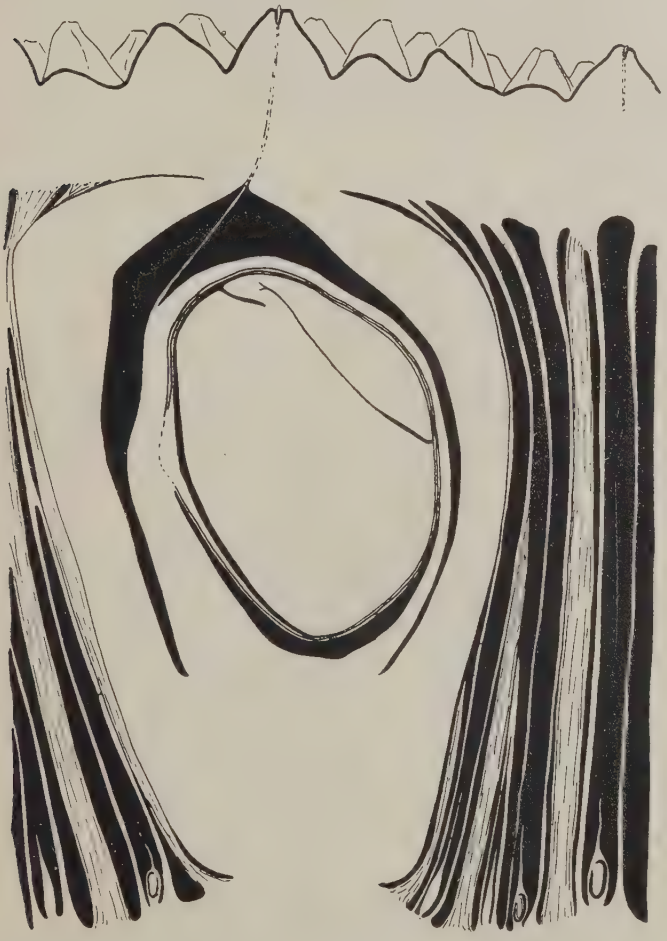
The Wild Chempedak is clearly conspecific with the cultivated Chempedak. It differs from the cultivated in its variable hairiness, its more oblong leaf without autumn tints, its more spiny, barrel-shaped syncarps without smell, its rather tasteless seeds and, apparently, its conical male



TEXT-FIG. 3.

Jack: longitudinal section through the ripe seed *in situ*, the spaces between the flowers, between the perianth-tube and ovary, and between the ovary-wall and ovule, or fruit-wall and seed, in black: x 2.

inflorescences with stouter stalks and larger stamens. Malays to whom I showed the fresh wild fruits in Singapore, after much deliberation, declared them to be a new idea the "Nangka-Chempedak", so impressed were they by their shape and absence of smell, as well as by the hairlessness of the twigs. Botanically however, such resemblances with the Jack are trifling, and perhaps insignificant, when



TEXT-FIG. 4.
Chempedak: as Text Fig. 3, x 2.

weighed against the exact similarity with the Chempedak in structure of leaf-blade, fruit and seed.

The main specific differences between the Jack and Chempedak (now in its widest sense of the cultivated and wild forms) concern—

1. the shape of the base of the lamina;
2. the colour of the fresh leaf;
3. the size of the male inflorescence;
4. the presence or absence of the annulus at the base of the flower-head;
5. the size of the male-flower;
6. the shape of the style-apex;
7. the adherence of the wall and core of the ripe syncarp;
8. the texture and shape of the fruiting perianth;
9. the structure of the fruiting pericarp;
10. the size and attachment of the style in the fruit;
11. the attachment and shape of the seed;
12. the structure of the testa;
13. the dissimilarity of the cotyledons;
14. the position of the radicle.

Between the Jack and Cultivated Chempedak one may also add the hairiness and the shape and smell of the ripe fruit, perhaps also its surface markings, but all these points are annulled by the Wild Chempedak. A strigose shoot therefore indicates the Chempedak, but a glabrous shoot may be either Jack or Chempedak.

PART II, SYSTEMATY

The Identification of Artocarpus integer (Thunbg.) Merrill

1. The basinym of *A. integer* is *Rademachia integra* Thunbg., the original description of which is in Swedish and Latin. The following copy has been sent to me by Professor Svedelius, the Swedish being translated into English:—

> "Description of a new genus, called RADEMACHIA, which has already been depicted and described although incompletely by Rumphius; but now carefully investigated after the new sexual method.
>
> *by* C. P. THUNBERG, M.D.
>
> Act of the Royal Swedish Academy of Science, vol. XXXVII, 1776, p. 254.
>
> 2. sp. *R. integra:* foliis indivisis.
>
> It is called in Malay 'Tjampeda' and the fruit is called Nanca. *Saccus* arboreus major s. Nanca or Soorzak-boom; Rumph. Herb. Amboin. tom. I. p. 104. tab. 30.
>
> *Saccus* arboreus minor s. Tsjampadaha, Rumph. Herbar. Amb. tom. I. p. 107. tab. 31.

It grows in Java, around Batavia, in Amboina and other places. The root, the stem, the branches and the flowers in this species just as in the foregoing one (= *R. incisa*).

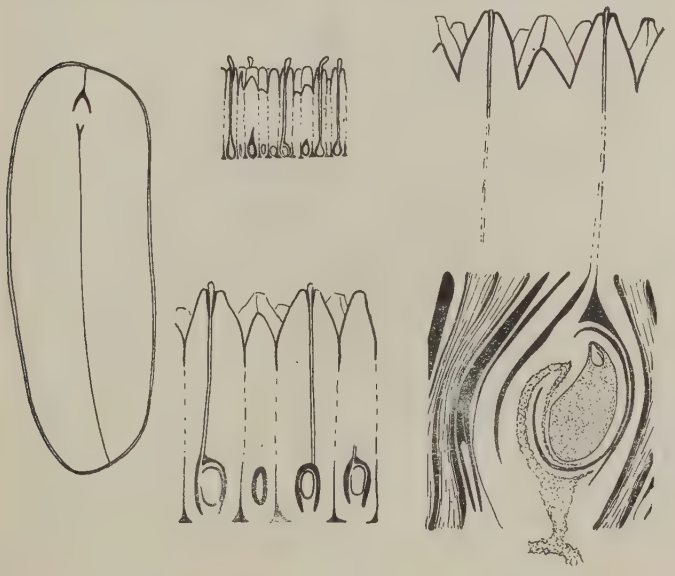
Folia alterna, petiolata, ovato-oblonga, *obtusa cum acumine obtuso*, integerrima, indivisa, nervosa; supra læte viridia, lævissima; subtus pallidiora, *pilis rigidis hirsuta, patentia, spithamaea. Petiolus* subtriqueter, glaber pollicaris.

Ramuli pilis longis rigidis hirsuti, uti etiam pedunculi. *Stipulae*, ut in priori. (= *R. incisa*).

Batavia, d. 15 Junii 1775."

The important points to note in the description are "Folia ..... supra laete viridia ..... subtus pilis rigidis hirsuta, patentia, spithamaea" and "Ramuli pilis longis rigidis hirsuti, uti etiam pedunculi", also the localities Java and Amboina.

From the description one may deduce *a*, that Thunberg collected specimens of Chempedak on his expedition to Java; *b*, that he drew up his description from these specimens in Batavia, most probably from living specimens; *c*, that his description is in no way a copy of the Rumphian, because



TEXT-FIG. 5.

Three stages in the development of the **Jack**-fruit, the youngest at anthesis, the oldest with the embryo-sac (stippled) containing the young embryo and supplied by a stout vascular bundle (speckled). *left* a mature seed of the **Wild Chempedak** (Sing. F. No. 32988) all x 2.

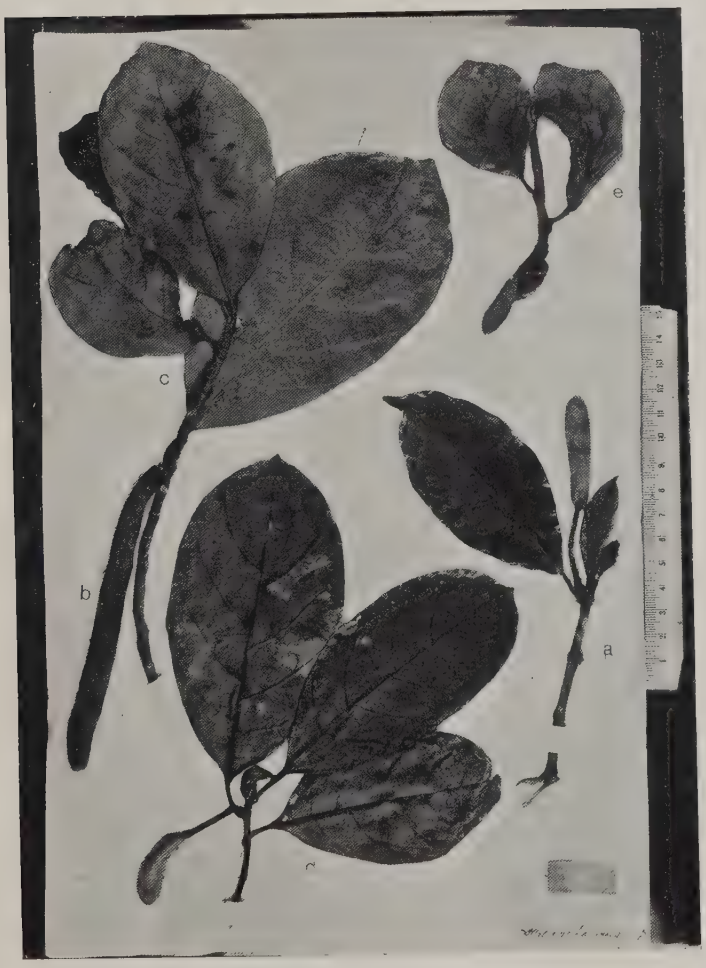
he limits it to the vegetative characters noted by himself; *d,* that he mistook the fruit of the Jack (nanca) for that of the Chempedak and, therefore, *e,* he quoted both *Soccus arboreus major* and *minor* of Rumphius as synonyms of the Javanese Chempedak; *f,* Amboina was given as the Rumphian locality.

The description indicates the Chempedak, not the Jack, and this interpretation is born out by Thunberg's type-specimen.

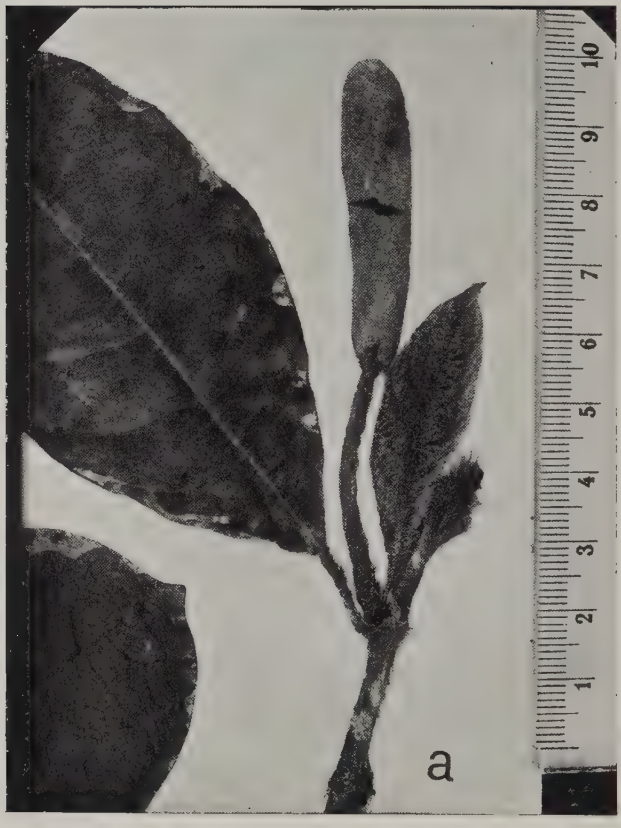
2. *The Type-Specimen.*—The following extract from Professor Svedelius' letter, together with the two photographs of the type-specimen sent by him and reproduced in Plates 1 and 2, will speak for itself. The decurrent leaf-base of the Jack, the pointed blade of the Chempedak, the hairiness of the latter and the annulus on the male inflorescence of the former can be seen in the photographs.

> "If we now examine the type-specimen of Thunberg's *Rademachia integra* in herb. Thunberg, it will soon be obvious that on the herbarium-sheet *both your species have been fixed together* [*viz.* Chempedak and Jack]. I send you a photographic copy of the whole sheet. From this it is clear that *a* and *b* exactly correspond with Thunberg's description of *Rademachia integra.* They are the type of *R. integra.* It is quite evident that both *a* and *b* (the male receptacle) have the long stiff yellow hairs so characteristic for the Chempedak, further the peduncle (male) is not dilated [*i.e.* without an annulus]. The leaf of *a* corresponds also very well with the leaves of the Chempedak which you have sent us. *c–e* on the other hand must belong to the jack-fruit. Especially *d* and *e* show that the male receptacles are quite different from *a* and *b.* Also their leaves correspond with those of the jack-fruit. Thus these two plants have been fixed together on the same herbarium sheet. In former times botanists were not so careful regarding labels and especially not regarding collecting localities. Thunberg apparently collected *R. integra* in Java and Amboina (Cfr Thunberg *1781* p. 412). In his collections he had also the jack-fruit from Ceylon, but in his first description of *R. integra* (*1776*) he does not quote Ceylon as a locality. Later, many years after Thunberg came home, he had all his collections from South Africa, Ceylon, Netherlands Indies and Japan mounted for the herbarium and probably a mistake was then made and a piece of the Chempedak from Batavia was fixed together with the jack-fruit from Ceylon on the same paper. Thunberg had namely made a note on the back of the herbarium-sheet "e Ceylona Thunberg". There, probably, Chempedak does not occur.
>
> The type-specimen *a* and *b* clearly correspond with Thunberg's description of *Rademachia integra* (*Sitodium macrocarpon*) "pilis longis hirsuti" and Thunberg quotes the Malay name Tsjampedaha! Thus you are quite right if you say that the Chempedak must be named *Artocarpus integra* (Thunb.)."

The Ceylon-specimens of the Jack cannot be considered as part of the type of *R. integra* because Ceylon was not mentioned as a locality in the original description, and



Thunberg's specimens of **Chempedak** and **Jack**
a, b, *Radermachia integra* Thunb. [=*Artocarpus integrifolia* (Thunb.) Linn f.], the **Chempedak:**
c, d, e, *Artocarpus integra* auctt. (=*A. heterophyllus* Lam.), the **Jack.**
(from Thunberg's herbarium, by courtesy of Professor N. E. Svedelius, Botanical Institute, Uppsala).



Part of Plate 1, enlarged: the **type** of the **Chempedak.**

Thunberg would not have made this omission if he had already collected specimens there himself. It was not until his later paper on Sitodium *1779 (vide infra)* that he added Ceylon and thoroughly confused both species.

3. *Conclusion.*—I agree with the following extract from Professor Svedelius' letter:—

> "That the herbarium-sheet with the two species together cannot force us to give the name 'integra' or 'integrifolia' to the jack-fruit clearly appears from the very clear description of Thunberg and also Linné fil. The diagnosis speaks for the Chempedak and when also the original of Thunberg's *Rademachia integra* shows the same it seems to me that you are quite right when you give a name to the jack-fruit and reserve the old species name '*integra*' for the Chempedak."

In other words the correct name for the Chempedak is *A. integer* (Thunb.). The combination has already been made by Merrill in the belief that he was dealing with the Jack. The full botanical title of the Chempedak must therefore be:—

Artocarpus integer (Thunb.) Merrill non sensu Merrill, Interpr. Rumph. Herb. Amboin. *1917*, p. 190.

Synonyms of the Chempedak

Artocarpus integrifolia Linn. f., Suppl. *1781*, p. 412.

Sitodium macrocarpon Thunb., Phil. Tr. Roy. Soc. LXIX, *1779*, pt. 2, pp. 467–473.

Sitodium cauliflorum Gaertner, Fruct. Sem. Plant. *1788*, vol. 1 p. 345; vol. 3, t. 71, 72.

Artocarpus Jaca Lam., Enc. Meth. Bot. III, *1789*, p. 209, t. 745.

(*Soccus arborcus minor* Rumph., Herb. Amboin., tom. 1, p. 107, t. 31).

Artocarpus integrifolia Linn. f.

The description is merely an abbreviation of Thunberg's for *R. integra*, which name is cited as a synonym. According to the International Botanical Rules of Nomenclature *1935* Art. 60 (1) as emended at the 6th International Botanical Congress in *1935*, *A. integrifolia* is a superfluous, and therefore illegitimate, name. The following extract from Prof. Svedelius' letter confirms this opinion:—

> "The type-specimen of *Artocarpus integrifolia* L. fil., described by the younger Linnæus (filius) 1781, probably does not exist if it is not the specimen in herb. Thunberg. If it belonged to the Linnæan herbarium it ought to be in the Linnæan Herbarium in London. Dr. B. D. Jackson however in his Index to the Linnæan Herbarium (London *1912*) mentions only one species of Artocarpus *viz. A. lobatus* L.f. (1087) but no Rademachia and no Sitodium..... Note that Linnæus fil. here [*i.e.* in his description of *A. integrifolia*] only mentions Java and Amboina as home!"

It is clear therefore that Thunberg's Ceylon-specimen of the Jack did not enter even into *A. integrifolia,* which is solely the Chempedak except for the reference to the Rumphian *Soccus arboreus major:* not even the name 'nanca' is mentioned.

Sitodium macrocarpon Thunb.

In this year Thunberg altered Rademachia (now spelt Radermachia) to Sitodium, evidently on the instance of Banks, as Rademachia was pre-occupied. Under *S. macrocarpon* Thunberg gave *R. integra* as a synonym; therefore, *S. macrocarpon* is also a superfluous name (Intern. Bot. Rules *1935* Art. 60, 1). The description is extended and muddled by the attribution of the fruit of the Jack to the foliage of the Chempedak. Ceylon and India were given as localities. 'Jacca' and 'Nanca' were given as vernacular names and Rheede's Tsjakamaram (Hort. Mal. 111, p. 17), which is unquestionably the Jack, was given as a synonym. The 'Observationes', on pp. 471–473, show how thoroughly Thunberg had now confused the species. As Professor Svedelius remarks, it must have been after this date the Ceylon-specimens of the Jack were fixed to the same sheet as the specimens of Chempedak from Batavia.

Sitodium cauliflorum Gaertner.

This synonym provides an instance of the awkward retrospective action of the Rules of Botanical Nomenclature. As a synonym of *S. cauliflorum,* Gaertner gave "Artocarpus foliis integris Linn. Syst. Veg. 838": the number 838 refers to the page in J. A. Murray's edition (*1784*) of Linnaeus' work. From the remarks at the foot of page 345, Gaertner intended *A. integrifolia* L.f. as a synonym. *S. cauliflorum* therefore covers the type of *A. integrifolia* L.f., which has *R. integra* as its basinym. *S. cauliflorum* must therefore be treated as another superfluous name for the *Chempedak* and so, nomenclaturally, illegitimate. Though his description and figure represent only the Jack, Gaertner did not distinguish it from the Chempedak, c.f. his Rumphian citations, and he was evidently no better informed in this respect than his contemporaries.

Artocarpus jaca Lam.

According to the same Article of the Rules and in spite of the fact that Lamarck was the first of the post-Linnean authors to discern some difference between the Chempedak and the Jack, *A. jaca* must also be treated as a superfluous name *for the Chempedak* though intended primarily for the Jack. Lamarck realised that *Soccus arboreus minor, R. integra* and *A. integrifolia* differed from the Jack in being hairy and accordingly made them "La variété B"

of *A. jaca.* He thereby instated an invalid pre-Linnean epithet (from *Iridaps Jaca* Commerson) for that of the valid *R. integra.* According to the Rules in retrospect, Lamarck should have made the glabrous Jack a variety of the hairy *R. integra* and should have made the new combination *A. integra* (Thunb.) with a variety *jaca.* If one considers that the Rules deal hardly with Lamarck in this case, it cannot be denied that he profits undeservingly by them with his contemporary name *A. heterophyllus* which, devised in ignorance, becomes the legitimate name for the Jack.

Polyphema Champeden

Polyphema Champeden Loureiro, Fl. Cochinch. *1790,* p. 547.

= *Artocarpus Champeden* (Lour.) Spreng., Syst. 3, *1826,* p. 804.

A. Polyphema Pers., Syn. *1807,* II, 531.

This species has always been interpreted as the Malayan Chempedak, the most recent affirmation being Merrill's (Comm. Lour. Fl. Cochinch., Tr. Am. Phil. Soc. XXIV, *1935,* pt. 2, 135). It seems to me, however, that its identity has by no means been solved and that Merrill's interpretation lacks proof. My own opinion is that *P. Champeden* is a 'mixtum compositum' for the following reasons:—

1. The description embraces plants from three sources:—

a, Cochinchina:—"Habitat in altis sylvis Cochinchinae": Loureiro lived in Cochinchina: his book is a Flora of Cochinchina: he quotes a Cochinchinese vernacular name.

b, Malacca:—"circa fretum Malaccense habitantibus",

c, Amboina:—in quoting *Soccus arboreus minor* of Rumphius.

2. Nevertheless, Merrill says that "Loureiro's description was based on plants observed by him near Malacca ....." and that there is a specimen of Loureiro's at the British Museum. Such a specimen was not mentioned by Spencer Moore in his investigation of Loureiro's types (Journ. Bot. *1925,* p. 245.). Mr. Taylor tells me that he has been unable to find the specimen and that there is no mark against the species in the British Museum's copy of Loureiro's Flora to show that it was received. Merrill's contention thus appears groundless; and the interpretation of *P. Champeden* from a Malaccan species is out of the

question. To me it is obvious that Loureiro identified plants that were familiar to him as 'cây mit nai' in Cochinchina with *Soccus arboreus minor* of Rumphius and, perhaps, with trees of Chempedak that he had seen or had heard of in Malacca, and that, in deference to the priority of Rumphius, which was then acknowledged, he mistakenly applied the name 'Champeden' to the Cochinchinese species. Manifestly Loureiro described his species from Cochinchinese plants.

3. If one interprets Loureiro's species as the Malayan Chempedak, then according to Gagnepain (Fl. Gen. Indoch. v, *1928,* 734) it does not grow in Indochina where Loureiro said it did.

4. If Loureiro's species is the Malayan Chempedak, it should have been characteristically hairy but all that Loureiro said was "foliis ..... pilosis, rugosis, sparsis" and, whatever such words may mean, they were obviously borrowed from Rumphius (see 6, below). The hairiness of the petiole, peduncle, twigs and buds would not have escaped so acute an observer as Loureiro. This discrepancy convinces me that at the time of writing his description of *P. Champeden,* Loureiro had only specimens of a Cochinchinese species which he wrongly identified with the Chempedak, that he borrowed from the description of *Soccus arboreus minor,* and that in his misapplication he overlooked the most obvious character of the cultivated Malayan Chempedak.

Moreover, in his 'Observatio' under the preceding species, *P. jaca,* Loureiro said that both *P. jaca* and *P. Champeden* had *not* "pedunculi pilis longis hirsuti", which are the words used by Linnaeus fil. (and Thunberg) in describing the type-specimen of Chempedak as *A. integrifolia.*

5. Loureiro wrote of the inflorescence-heads of *P. Champeden* "Amenta oblongo-ovata" and in the 'Observatio' under the preceding species, *P. jaca,* remarked that he had never seen the "amentum cylindricum" described for *Artocarpus integrifolia,* quoting this as one of his reasons for doubting the identity of Artocarpus and Polyphema. Now the Chempedak has 'amentum cyclindricum', as Thunberg's specimen displays. How then can it be *P. Champeden?*

6. Parts of Loureiro's description are copied from Rumphius' description of *Soccus arboreus minor.* A genuine description would have had the freedom of Thunberg's. Thus:—

> "Folia ..... rugosa, pilosa, superius obscuro-viridia, subtus flavescentia" (= "folia ..... superius obscure virentia, inferius flava ..... rugosa et pilosa" Rumphius).

"baccæ vix pedem longe, 4 pollius latæ, flavo-virides (= "fructus ..... pede nempe modo longus, quatuor vel quinque crassus digitos ..... Exterior flavo-viridis ....." Rumphius).

Thus far Loureiro undoubtedly described the Malayan Chempedak as copied from Rumphius. Paragraphs 4 and 5, above, show that he also meant some other plant.

7. I conclude that *P. Champeden* is an unidentified species "amento oblongo-ovato" from Cochinchina, and that the application of the name to any species of Artocarpus should be withheld until it can be proved to be a Cochinchinese species. The vernacular name 'cây mit nai' is still in use for several species in Indochina (Gagnepain).

I have gone into this matter in some detail in order to show how necessary it is to support with botanical proof identifications, name-changes and reductions, if it is intended that they should be accepted by botanists. There has been as much confusion over *P. Champeden* as over *A. integer* because systematists have been content to copy and cite authority in both cases without botanical verification.

The Wild Chempedak

From its barrel-shaped, inodorous syncarps, the almost tasteless pulp round the seeds, the lack of rich autumn-tints in its withering leaves and its natural habitat in the high forest, I consider that the Wild Chempedak should be distinguished as a variety of *A. integer* and I propose for it the name *silvestris*. I have seen sufficient number of trees in different parts of the country to feel assured of the constancy of these characters. May be the shape and large size of the male inflorescence and the larger stamens are distinctive but observations from other trees will be needed to establish these points. In the hairiness of the leaf and twig, and the prominence of the spines on the syncarp there are evidently individual differences among the trees suggesting forms or varieties. One would expect, also, some differences in the taste of the pulp tending toward that of the cultivated Chempedak, of which the wild variety is undoubtedly the ancestor.

The Wild Chempedak has been found only in Malaya. It appears to be not uncommon in the forest from sea-level to moderate altitudes (4,000 ft.) and it is abundant enough in the Tahan Game Reserve in the middle of Pahang, where the wild forms of many of our local fruit-trees are to be found, at least according to the Pahang Malays. The Wild Chempedak begins to fruit when a small tree 30 or 40 ft. high, when it is cauliflorous: old trees, reaching 130 ft., seem to become completely ramiflorous. In general

appearance and from dried specimens of leaf and fruit, it is indistinguishable from the cultivated Chempedak.

A. integer var. **silvestris** var. nov.

Bangkong, Chempedak Utan, Baroh (Johore), Wild Chempedak.

Arbor silvestris, incultus: syncarpiis ellipsoideis vel oblongo-ellipsoideis, inodoris: pulpa seminis subacida, insipida: foliis senescentibus vix lutescentibus.

Collections:—

Wray 1356 (Tapah, Perak), scarcely hairy;
Kunstler 1636 (Penang), hairy; ? cultivated;
Strugnell 14627 (Fraser's Hill, Pahang, ca. 1200 m.), subglabrous;
Ridley s.n. (Tahan River, Pahang), hairy;
Ridley s.n. (Simpang Mines, Selangor), subglabrous;
Ahmad 4586 (Weld Hill, Selangor), subglabrous;
M. Nur 11254 (Fraser's Hill, Pahang, ca. 1500 m.), subglabrous;
Kiah s.n. (S. Kayu, Johore), subglabrous;
Corner 32988 (Johore), glabrous (**Type**);
Corner 33205 (Fraser's Hill, Pahang, ca. 1200 m.) hairy;
Corner 33688 (K. Teku, Pahang, ca. 300 m.) hairy;
Corner s.n. (S. Tahan, Pahang, 8.9.37) hairy;
Corner s.n. (Fraser's Hill, Pahang, 14.8.37) hairy.

The Botanical Names for the Jack

Artocarpus heterophyllus Lam., Encycl. Meth. Bot. vol. III, *1789,* p. 209.

Syn. *A. philippensis* Lam., ibid. 210; Willd. sp. Pl. 4. *1805,* p. 189.

Polyphema Jaca Lour., Flor. Cochinch. *1790,* p. 546. haud *A. jaca* Lam. (1789).

A. maxima Blanco, Fl. Filip. *1837,* p. 669.

(*Tsjakamaram,* Rheede, Hort. Malab., III, *1682,* t. 26–28).

(*Soccus arboreus major* Rumph., Herb. Amboin., tom. 1, p. 104, t. 30).

I have not seen the type of *A. heterophyllus* but the species has been universally admitted as a synonym of the Jack and Lamarck's description and reference to *Soccus arboreus major* of Rumphius permit no doubt. Lamarck described the annulus at the base of the male inflorescence, which seems not to occur in any other Artocarpus though probably it is morphologically comparable with the bracts of Parartocarpus. *A. heterophyllus* is the first undoubted description of the Jack which does not include *R. integra* Thunbg., and therefore it must be its legitimate botanical name. Lamarck intended his species for the "Nanca" of Rumphius and supposed that the Jack of India was different. The type of the Jack must therefore be Commerson's specimen in Lamarck's Herbarium in Paris,

consisting of the precocious male inflorescences and the sapling leaves of a seedling raised "au Jardin du Roi, à l'Isle de France". Such are the histories of Tropical Botany.

In reducing *A. philippensis* to the Jack, I follow Elmer (Leaflets, II, *1909*, p. 612) and Merrill (Enum. Phil. Pl. II, *1923*, p. 41) though I cannot find that these authors have given any reasons or that anyone has investigated the type. Lamarck distinguished *A. philippensis* by its blunt, retuse obovate leaves, but such leaves are occasionally met with in the Jack, especially if the bud has been damaged. I find commonly that the very blunt, retuse shape of the leaves of many tropical trees is by no means as characteristic as a few specimens might lead one to suppose, but in most cases has been caused by some abnormality in leaf-growth. Lamarck described also a narrow involucral annulus at the base of the male inflorescence of *A. philippensis*, which feature should clinch its identity with the Jack. The type must be Sonnerat's specimen from the Philippines in Lamarck's herbarium at Paris.

A. heterophyllus Lam. and *A. philippensis* Lam. were published simultaneously. In choosing *A. heterophyllus* for the Jack, I have selected the less inappropriate name. Though there seems to be some difference between sapling and adult foliage in nearly all species of Artocarpus, the epithet *philippensis* would be very misleading.

It is true that Willdenow reduced *A. heterophyllus* to *A. integrifolia*, in the belief that *A. integrifolia* was the Jack, and that he retained *A. philippensis*, but it cannot be said that he in any way made a choice between *A. heterophyllus* and *A. philippensis* as synonyms of the Jack. His reduction of *A. heterophyllus* was erroneous. Indeed Willdenow was thoroughly confused because he gave the name *A. integrifolia* to Lamarck's *A. jaca* and also distinguished Lamarck's variety B which was based on *A. integrifolia*. If Willdenow had made a selection between *A. heterophyllus* and *A. philippensis* it should have been as varietal names for his *A. integrifolia* variety γ.

P. Jaca Lour. and *A. maxima* Blanco are generally interpreted as the Jack. The names are unfortunately antedated. There is an original specimen of *P. Jaca* at the British Museum, which Mr. Taylor informs me is the Jack in cultivation in Indochina.

Varieties of the Jack

In Malaya the Jack is remarkably uniform and conforms exactly with the description in Ochse's two works. In Ceylon and, especially India, I understand that there are

many varieties, but precisely how they are to be distinguished seems not to have been stated. It would be well if some Indian botanist were to describe them bearing in view the points of distinction between the Jack and Chempedak which I have enumerated. Thus the two varieties known in Burma as Talaing and Kala seem to differ from the Malayan Jack in having longer, more crowded and blunt spines and the taste of all three is distinctly different.* I wish, however, to draw especial attention to two varieties.

In the first place, there is said to be a variety which bears fruits on the roots. The fruits develop underground and as they swell they raise small mounds which they eventually burst, and thus they disclose themselves. This variety is said by Malays to occur in Malaya, but very rarely, and it was noted also by Thunberg in his observations on *Sitodium macrocarpon* (Phil. Trans. Roy. Soc. vol. LXIX, pt. 11, *1779*, at the top of p. 472). The fruits are said to be exceptionally large and most delicate of flavour—"a duobus servis portari debeant singuli, hique fructus maxime delicati aestimantur". It appears that no botanist has ever seen this variety. The fruits must be developed on adventitious root-suckers.

In the second place, there is said to occur in Ceylon a variety called "Vela" which is "characterised by its softer pulp, through which the finger may be thrust when approaching ripeness" (H. F. Macmillan, Tropical Planting and Gardening, 1935, p. 250). It seems that the plant described by da Costa in India as "Gerissal" is also the same as can be judged from the following quotation:—

> "970—The Jack-fruit has also many varieties, the principal and easily noticeable ones being the BARICA (Borcoi or Capo) and GERISSAL (Ponosso or Rossal). The Barica-fruit is firm and hard, and its pods (pips) are easily detached entire and can be cut into small pieces. The Gerissal is soft, and its pips are so soft (branda) and juicy that they cannot be cut into pieces and hence they are put entire into the mouth. It might be doubted whether these two kinds of plants are really two species or two varieties of the same species, so great are the noticeable external differences: but if the common opinion is true that the Barica-seed, when sown, gives Gerissal-plants and *vice-versa*—an opinion also affirmed in the ARTE PALMARICA 44, but which I have not verified—then it is clear that these two kinds of plants are varieties and not two species .....
>
> 971—Under each of these two varieties there are many subvarieties which differ in taste, colour, fibrousness and

* I am indebted to J. W. Grant, M.A., B.Sc., I.A.S., Rice Research Officer, Burma, for kindly sending me fresh specimens of both varieties. (Dept. Agric., Burma, Bulletin No. 30, *1936*, p. 57, J. W. Grant and A. N. P. Williams).

sweetness of their pips. However, unlike the subvarieties of Mangoes, none of these subvarieties has received any particular name, a fact which might be attributable to the lack of demand, ability or knowledge on the part of the farmer to perpetuate the varieties by artificial propagation". (Manual Practico do Agricultor Indiano, vol. 2, *1874*, p. 148).

The "Vela" and "Gerissal" suggest a variety of the Chempedak which is glabrous, like some forms of the Wild Chempedak in Malaya, but possessed of better flavour. So far as I can ascertain, there is no record of the Chempedak from India or Ceylon, but if the hairy Malayan Chempedak has been confused with the Jack, how much more may not a glabrous variety be? Mr. Furtado informs me that he remembers in the neighbourhood of Goa two varieties of Jack, one with the firm fruit, firm pulp and crinkly seed of the Jack proper and the other with the soft baggy fruit, the soft pulp and almost testa-less seed of the Chempedak, but that both kinds were glabrous: in fact he did not associate hairiness with the character of the Chempedak until he met with it in Malaya. I would ask, therefore, the botanists in Southern India to investigate the cultivated Jack to see whether some varieties may not really belong to the Chempedak. My request for specimens of "Vela" from the Department of Agriculture in Ceylon met, unfortunately, with no response.

Specimens of 'Koolai' and 'Varika', sent by Mr. Broadfoot from Coimbatore, have proved to be varieties of Jack. So also have the 'Talaing' and 'Kala' of Burma but the Burmese 'Sone-ka-dat' from Moulmein is the cultivated Chempedak. For the discovery of this fact, which becomes the first record of the Chempedak north of the Malay Peninsula, I am indebted to Mr. Grant who suggested the possibility to me in a letter.

The Confusion of Jack and Chempedak

The specificity of each was fully grasped by Rumphius in whose excellent descriptions of *Soccus arboreus major* and *S. a. minor*, written in the 17th century, the main distinctions were clearly stated. It is doubtful if Thunberg realised that he was dealing with two species, although his first attempt with *Rademachia integra* was fortunately precise. His second attempt, with *Sitodium macrocarpon*, was confused. Gaertner, evidently, knew only the Jack. Lamarck perceived some discrepancy between *Soccus arboreus minor* and *R. integra*, on the one hand, and the Jack on the other hand, but he believed that the "Nanka" or *Soccus arboreus major* of Rumphius was yet another

species. Loureiro distinguished a second species from the Jack, ascribing to it the Rumphian *Soccus arboreus minor* and the Malayan Chempedak as well as a Cochinchinese species, but what this latter was has not been ascertained. Because Loureiro gave the name Champeden to his species, botanists subsequently identified the Malayan Chempedak as *Artocarpus Champeden* (Lour.) Spreng. without enquiring into its exact nature and this error has been copied to the present day. The very accurate figure and description of the Jack, as *Artocarpus integrifolia,* by W. J. Hooker (in Curtis' Bot. Mag. vol. LV. *1828,* t. 2833, 2834), written in ignorance of the Chempedak, contributed probably to the greatest extent in perpetuating the error. Sprengel, Persoon and Willdenow were merely copyists. But if King had not omitted, for some unaccountable reason, the Jack from his monograph of "Artocarpus in British India" (Ann. R. Bot. Gard. Calc. II, *1889*), these nomenclatorial researches of mine would undoubtedly have been unnecessary.

A. integer as a nomen specificum conservandum

I find that it has been proposed by Indian foresters to conserve the name *A. integer,* or *A. integrifolia,* for the Jack of India. Hitherto the conservation of specific names has been discountenanced at Botanical Congresses, and the present instance shows what a dangerous precedent it may create. The confusion between Jack and Chempedak can be ascribed only to the incompetence of systematists and their lack of acquaintance with the plants which they have tried to classify. Nor have any practical men, so far as I can ascertain, endeavoured to assist systematists in this actual instance. The conservation of specific names can be accepted only if botanists agree to forego entirely their principles of priority and typification, in other words to throw over their system of nomenclature, and to adopt arbitrary names for every species. And supposing such, what is *A. integer* of India, the Chempedak or the Jack, because both species evidently grow there and have been mistaken for each other? Let us rather acknowledge the ignorance that still prevails concerning the systematy of tropical plants and direct our efforts to overcome this. I find that confusion in botanical names is always accompanied by a confusion in practice, for it is not merely wrong identification that is at the bottom of the grievance but an acute lack of knowledge. It is time, surely, that tropical systematy was removed from the "hortus siccus" to its rightful place in the Botanic Gardens of the tropics.

Gardens Bulletin, S.S.

Summary

By reference to the original description and type-specimen of *Rademachia integra* Thunbg., I have shown that the combination *Artocarpus integer* (Thunbg.) Merrill, published in *1917*, as the legitimate botanical name for the Jack, is really another species called the Chempedak. The Jack must, therefore, be called by its earliest legitimate synonym which is *Artocarpus heterophyllus* Lamarck (*1789*).

The type-specimen of *A. integer* is in Thunberg's herbarium at Uppsala. The type of *A. heterophyllus* is in Lamarck's herbarium in Paris.

I have contrasted in detail the macroscopic characters of the Jack and the Chempedak in both its cultivated and wild states. The species differ in some two dozen features, the most important of which concern the base of the leaf-blade, the base of the inflorescence-head and the structure of the syncarp, true-fruit and seed.

The two species were much confused by the early botanists and it seems that they still are confused in Southern India. The Sone-ka-dat of Burma is the Chempedak.

It is much to be desired that the status of the Indian Jack in all its varieties should be thoroughly examined.

The Wild Chempedak of Malaya is distinguished as *A. integer* var. *silvestris* var. nov., chiefly on account of its broad inodorous fruits, the insipid pulp round its seeds and its wild habitat.

The synonymy of the two species I have discussed with the conclusion that *Artocarpus Champeden* (Lour.) Spreng. must be a Cochinchinese species different from the Chempedak and one that has not been recognised again. It seems to have been as much misinterpreted as *A. integer*.

The objection to *nomina specifica conservanda* is discussed.

A REVISION OF FICUS, SUBGENUS SYNŒCIA

By E. J. H. Corner, M.A.,

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When King's monograph of Ficus appeared fifty years ago, there were six species of Synœcia. Eleven others have since been described, one from Formosa, eight from the Philippines and two from Borneo. That from Formosa, *F. terasoensis,* has already been identified with the Philippine *F. megacarpa.* I now find that *F. megacarpa* is a leaf-variety of the widespread *F. callicarpa* and that five more of the Philippine novelties have been misplaced in Synœcia: four belong to Eusyce, and one has already been transferred to Urostigma. Of these eleven, there remain, as proved species, only two from the Philippines, namely *F. Bordenii* and *F. cataupi,* and one from Borneo, *F. tawaensis:* concerning *F. Simiae,* of Borneo, I am uncertain (p. 145).

In 1932 and 1933, the late Mr. C. E. Carr, F.L.S., collected for seven months on Mt. Kinabalu in British North Borneo. At my request he made a special study of wild figs, taking careful field-notes on the colours of the receptacles and preserving material in spirit as well as dried. He collected five species of Synœcia, four of which I describe as new in this paper, namely *F. barba-jovis, F. Carri, F. dens-echini* and *F. tulipifera.* The importance of this magnificent collection was at once evident from my own studies on the Malayan species; and it has led me to revise the subgenus. A fifth new species, *F. grandiflora,* I describe from a collection of Mr. and Mrs. J. Clemens, also from Kinabalu. I am obliged also to make four new varieties of *F. callicarpa.*

When thus pruned and extended, the subgenus contains 13 good species, two doubtful species (*F. Simiae* and *F. singalana*) and four varieties. To the descriptions, themselves, I have added several critical diagnostic characters, particularly of the flowers and leaves, that have been overlooked but without which the affinity of the species cannot be ascertained. Indeed, previous descriptions of the species convey little idea of their decisive character. I have arranged the species in what seems to be their natural order (p. 95), but our knowledge of the subgenus is very imperfect. That the number of species could have been doubled in the last ten years and that all these novelties should have come from one part of British North Borneo

reflect sadly on our ignorance of the flora of large areas of the Malay Archipelago. Because they are big climbers, the species have doubtless escaped the attention of field-botanists, for no other sort of plant is more difficult to collect. The uncertain specificity of *F. callicarpa* and *F. punctata* shows, too, the need of many more collections of these common plants from such countries as Sumatra, Borneo and Celebes, Palawan, Timor, Flores and the Moluccas. There is undoubtedly a variation afoot which suggests the persistent evolution of the species.

In spite of its expansion Syncœcia, as understood by King, remains a most natural subgenus. Its area of distribution must also indicate the natural limit of the greater part of the Malaysian flora (p. 91). When the distribution of the species is better known it will provide some critical evidence for the history of the Archipelago.

For the completion of this revision I was permitted to borrow the rich collections in the Herbaria at Buitenzorg, Manila and Calcutta, and I express my thanks to the Directors of these institutions, to Dr. D. F. van Slooten of Buitenzorg, Dr. E. Quisumbing of Manila and to Mr. J. D. Srinivasan of Calcutta, for their unstinted assistance. I have to thank also Mr. C. E. C. Fischer, of Kew Herbarium for kindly examining the type-specimen of *F. Scratchleyana* at the British Museum, and Dr. T. Sata of Taihoku Imperial University, Formosa, for a specimen of *F. terasoensis*.

In the citation of collections under each species only the collections that I have examined are mentioned.

Habit

All the species are root-climbers with tufts of short adventitious roots like ivy plants (Hedera). The main stems develop into stout trunks with greyish white bark: they are adpressed to the trunk of the supporting tree, though old stems may break loose and hang like the descending roots of a Urostigma: they are commonly rather flattened and elliptic in section, even strap-shaped, and may reach 10–15 cm. in their long diameter. It appears that the plants always start from seeds on the ground—no doubt because animals do not eat the fruits: they first develop thin creeping stems that trail over rocks, earth and fallen trunks and branches until they reach a living tree up which they ascend to heights of 50 metres and more.

In manner of branching and dimorphic foliage, the species present two conditions, which I consider important because they indicate the state of evolution of the species. I have used this distinction in the key on p. 95, though it must be admitted there is no information of the condition in several species because such can be learnt only from

living plants. *F. apiocarpa,* which seems the least specialised member of the subgenus, has long branching leafy sprays that loop and trail over the limbs of the support, and there is no other difference than one of size between leaves on its aerial branches and those that creep on the ground. I presume that *F. Bordenii* and *F. Scratchleyana* also have this habit. But in *F. punctata* and *F. callicarpa* the hanging leafy sprays in the upper part of the plant are short and sparingly branched, not entangling the crown of their support, and they bear leaves of a different shape, as well as of a much larger size, from the branches that creep on the ground and over the trunk of the support. One may conveniently use the terms *bathyphyll* and *acrophyll* for these kinds of leaf, in the sense in which they have been employed by Holttum for the climbing ferns Teratophyllum and Lomagramma (2, 3). The leaves which are born on the lower, creeping shoots and are themselves flattened to the trunk or substratum which the stem is creeping over, are the *bathyphylls:* they may be juvenile leaves of young plants or the early formed leaves on side shoots of old stems. The leaves that are born on the free-hanging sprays in the upper part of the plant are the *acrophylls* and they are the normal adult leaves. Transitions between the two kinds of leaf always occur.

I think that all other species of Synœcia, except perhaps *F. dens-echini,* possess bathyphylls and are thus clearly in a higher state of vegetative, or scandent, evolution than *F. apiocarpa,* c.f. species of Willughbeia, Scindapsus, Teratophyllum. The attention of botanists should be drawn to the necessity of collecting both bathyphylls and acrophylls, or of recording the presence or absence of bathyphylls, in living plants because the distinction seems naturally to divide the subgenus into two groups.

In the following descriptions, the word 'leaf', unqualified, indicates the acrophylls, the bathyphylls being denoted only where necessary.

All the Malayan species are evergreen and I imagine this habit holds throughout the subgenus.

Leaves

Beside the distinction between bathyphylls and acrophylls, the leaves of certain species possess another important character which has been overlooked. The leaves of *F. apiocarpa, F. Bordenii, F. Scratchleyana* and *F. tawaensis* are simply tesselate on the underside, with flat areolæ between the reticulate veins. In all other species, these areolæ are pocked with white hairy pits in which the stomata are confined and thus, these species which have bathyphylls, again show a higher degree of vegetative

development. Indeed, I am convinced that the microscopic structure of the leaves will have an important place in the future classification of Ficus, though I have given the problem little more than the most superficial attention. Commonly the bathyphylls have no stomatal pits, but they may be found on the larger ones as well as on the transition leaves. *F. tawaensis*, so far as known, presents the intermediate state of a species with bathyphylls but without stomatal pits: it is just possible, however, that the acrophylls have not been collected. The stomatal pits are sub-epidermal in origin.

Between the species there are considerable differences in the size and shape of the leaves, but a few with different figs and flowers have very similar leaves, *e.g.*, *F. apiocarpa* and *F. Scratchleyana*, *F. Bordenii* and *F. dens-echini*, *F. callicarpa multinervia* and *F. grandiflora*, *F. cataupi* and *Ficus tulipifera;* while in *F. callicarpa* there is much variation in the leaf and remarkable constancy in the receptacles. I consider that where the receptacles and flowers have exactly the same structure, leaf-differences must be varietal, and that where the receptacles and flowers are different, a similarity of leaf cannot outweigh the specific distinction. [I am inclined therefore to unite *F. geocarpa* and *F. Beccarii*, described in my former paper on Covellia (1).] But the status of *F. punctata* and *F. callicarpa* is most unsatisfactory.

The asymmetry of the leaf-base is most marked in species with bathyphylls and stomatal pits and is practically absent from those without these features. The asymmetry is another mark of specialisation in the leafy sprays of the climber.

Receptacles

The figs of Syncœcia, which are among the largest and certainly the most beautiful in the whole genus, are very similar in structure and differ only in details of shape, colour, hairiness and position. These details nevertheless are characteristic and deserve some scrutiny.

In *F. apiocarpa* and *F. callicarpa*, many living specimens of which I have been able to examine, the general shape of the receptacle is so variable that I am led to doubt the value of this feature in any species until it has been proved from many collections. In contrast, the structure of the orifice, as seen in longitudinal sections, seems to offer reliable features and, as such can scarcely be conveyed by words, I have made drawings to scale from as many species as I had suitable material. The structure can be determined satisfactorily only in fresh specimens or those preserved in liquid, because the fleshy wall of the receptacle contracts strongly in drying and distorts the orifice.

A very short peduncle, a long neck and a little puckered mouth seem characteristic of *F. apiocarpa*, a perforate orifice of *F. barba-jovis*, large umbonate apical bracts of *F. dens-echini*, an umbonate apex of *F. punctata*, a rounded apex of *F. callicarpa*.

The colour of the ripening receptacle is characteristic, just as I found in Covellia and Neomorphe, but on this point there is too little information. Collectors should be urged to record the colours of fruits more carefully. I find, for example, that the marbling of the fig with pale spots is typical of *F. callicarpa*, *F. apiocarpa* and a few others, in contrast with *F. punctata* and those with very hairy figs. It seems that in all cases the fully ripe receptacles are deep purple or black and have a pleasant fruity smell. It is the colour that they turn before ripening that is distinctive and which renders them so vivid in the forest. In *F. callicarpa*, *F. apiocarpa* and, indeed, most species the figs change from light green through yellow and orange to brilliant red. In *F. punctata* and *F. tawaensis* they turn pink, orange-pink and pinkish red rather than orange-red. In *F. Bordenii* and *F. dens-echini* they are brown. In *F. Carri* they are olive brown to brownish purple. I have emphasized the importance of the colour in the key, on p. 95, because one is apt to be content with imperfect description.

In *F. apiocarpa*, *F. Scratchleyana*, *F. dens-echini*, *F. cataupi* and *F. trachycoma* the receptacles are axillary on the free-hanging leafy sprays, perhaps also in *F. Bordenii* but about this species there is no information. In the other species they are borne on the creeping stems on small woody knobs or leafless twigs that may elongate to a length of 10 cm., but the receptacles are never in big bunches as in Covellia. The axillary position is undoubtedly antecedent. Among the specimens of *F. callicarpa* there are a few which have unusually small, solitary axillary receptacles: I am inclined to regard them as the precocious fruit of young plants, but I have not found such living specimens myself. The axillary position in *F. trachycoma* and *F. cataupi* may also be found abnormal when these species are better known.

The largest figs are possessed by *F. tawaensis*, in which the body is said to have measured 12 cm. wide, and in *F. callicarpa angustifolia* of which I have seen a living specimen with the body (without neck) 14 × 10 cm. The smallest, apart from the little precocious axillary receptacles, are those of *F. tulipifera*, with the body 3 × 3.5 cm., and *F. cataupi* with the body 5 × 3 cm.

In *F. callicarpa angustifolia* the gall-figs are nearly twice as large as the seed-figs and they have a dingy colouring. Such a dimorphism in size occurs to some extent, I believe, in all species of Syncœcia and is, doubtless, to be

related to the much greater enlargement of the gall- and male flowers after the entry of the wasps into the receptacle than of the female and neuter flowers. If different species of wasps can live in the same species of Syncœcia, their specificity too may affect the size of the mature receptacle.

Concerning the biology of the fruits, one may remark that all animals seem to scorn these delightful objects. The gall-figs are naturally distasteful, being rather dry, when ripe, and full of insects, like those of Covellia and Neomorphe, but why should the seed-figs that are juicy and fragrant lie rotting on the ground? Malays always answer that neither birds, squirrels, monkeys nor bats will eat the fruits. Indeed, they commonly call the species of Syncœcia "Tangisong Burong" with such other plants as have bright inedible fruits over which the birds shed tears of disappointment. The seeds must be dispersed, therefore, very gradually by rains, fortuitously by floods or, as in the case of the riparian *F. apiocarpa,* by river-flow.

The wasps emerging from the ripe figs carry a fair quantity of pollen. It seems, however, that little can remain on their shiny bodies after their struggle through the orifice and down the long array of internal bracts, and it is difficult to understand how many hundreds, even thousands, of seeds can be set in one receptacle by ordinary pollination. I believe that figs are parthenogenetic, though the wasps must in some way stimulate the development of the ovule.

The entomology of Syncœcia is unknown. The figs harbour many inquilines as well as true fig-wasps and of these latter there must be several species, perhaps as many as there are species of Syncœcia, if one can judge from the size and structure of the gall-flowers. Whether the development of the gall-ovary can be altered by the species of wasp or inquiline that inhabits it is not known but it seems probable when one considers the variations in size of the flowers in *F. callicarpa* and *F. punctata.*

Flowers

The large size of the flowers and, particularly, the long stalks of the male and neuter flowers, are characteristic of Syncœcia. In my descriptions I have wherever possible taken the size of the flowers from mature receptacles because only such will give reliable and comparable figures. At their receptive stage in the half-grown figs, the gall- and female flowers, for instance, are minute and they enlarge in pedicel, perianth and ovary, though not in style, until the receptacle is nearly mature. The male flowers, also, are not full grown with expanded stamen until the wasps begin to fly out. At the receptive stage of the figs, the styles of the

gall and female flowers overtop their respective male and neuter flowers (Text Fig. 6) but subsequently the pedicels of these flowers elongate and they overtop the gall- and female flowers in mature receptacles. Thus, in their final size, the male flowers vary from 7–25 mm. overall, in the different species: *F. grandiflora* has the largest male flowers (20–25 mm. long) and the largest gall-flowers (up to 17 mm. long) though it is run very close by *F. callicarpa angustifolia: F. cataupi, F. Scratchleyana* and some forms of *F. callicarpa* and *F. punctata* have the smallest male flowers (7–9 mm. long). *F. dens-echini* has the largest female flowers (16 mm. long). In giving the size of the flowers it is important, also, to state the limits, especially of the gall- and female flowers, because short, tall and intermediate gall- and female flowers will be found, fully developed, in every receptacle, the difference in size depending on the relative development of pedicel and ovary-stalk. Concerning these two features, the distinction must be born in mind that the pedicel is proximal to the attachment of the perianth, the ovary-stalk distal. Thus, in *F. apiocarpa* and several others, the gall- and female flowers are more or less sessile but have commonly a long ovary-stalk, while in *F. dens-echini* they have a sessile ovary and a pedicel of greater or less length. In general structure, there is remarkable uniformity except the anomalous case of *F. apiocarpa* which lacks neuter flowers and has an almost colourless, membranous, denticulate perianth. In the other species, the perianth segments are wine-red, entire and more less thickly gelatinous. In the male flowers the perianth generally has 3 more or less gamophyllous, imbricate segments, but in *F. apiocarpa* there are 4 segments and in *F. Scratchleyana*, perhaps also in *F. dens-echini*, they are free. In the gall- and female flowers there are generally 3–4 perianth segments, free or slightly gamophyllous at the base, but in *F. grandiflora* and *F. dens-echini* there are commonly 5–6 and in *F. punctata* 0-3. In *F. apiocarpa, F. Scratchleyana* and, to some extent, *F. dens-echini* the perianth segments are relatively large, equalling or exceeding the combined length of ovary and style: in the other species they are generally much shorter. In *F. tulipifera* and *F. grandiflora* the segments are stout and often rather strongly gamophyllous. In all but *F. callicarpa*, the perianth-segments are simply attached by the whole base, like a multiseriate trichome, but in this one species the base of each segment is rounded and has a minute stalk placed a very short distance up the segment so as to form a tiny peltate attachment (Text Fig. 11). I consider this feature to represent an

advanced state, as I have not observed it in any other Ficus. *F. punctata* and *F. callicarpa* are very variable in size of flower and number of perianth-segments.

The opening of the male flowers is delayed, as usual in Ficus, until the wasps hatch. The anther is then exserted from the perianth in most, if not all species, but I find some uncertainty on account of the lack of fully mature receptacles. It happens very occasionally, that there are two stamens in a male flower (Text Figs. 3, 27, 29). In *F. callicarpa angustifolia* I found a few male flowers without stamens but containing a stalked, empty gall-ovary. The mature male flowers are always longer than the gall-flowers in the same receptacle.

The neuter flowers are like sterile male flowers. The perianth never opens but looks like a wine-red Crocus-flower in miniature. Sometimes it contains a sterile rod which resembles in shape an abortive pistil rather than a staminode. The neuter flowers generally overtop the female flowers in the same receptacle but in *F. Carri* they are of variable length. In *F. dens-echini*, perhaps also in *F. Scratchleyana*, the perianth segments are free.

Seeds

The seeds, too, are uniform and characteristic, with the single exception, so far as it is known, of *F. Carri* which has ovoid seeds without a flange: but these seeds may be abnormal. In size, they vary little from 1.6–2 mm. long in *F. punctata* to 2.2–3 mm. long in *F. apiocarpa* and *F. callicarpa parvifolia*.

The mature female flowers of *F. Bordenii, F. cataupi, F. tawaensis, F. tulipifera, F. grandiflora* and *F. barba-jovis* are not known.

It must be remarked how seldom collectors manage to gather both male and female specimens of dicecious plants.

Evolution of Synœcia

The evolution of long-stalked unistaminate male flowers, distributed thickly over the whole interior of the receptacle, of corresponding neuter flowers in the seed-figs and, as a consequence no doubt, the large size of the receptacle distinguishes Synœcia from other climbing figs. The origin of the subgenus is surely to be found in Eusyce in the affinity of *F. disticha* and *F. areolata*. Such species bear a distinct resemblance to the less specialised members of Synœcia, as *F. apiocarpa*, in having a similar creeping habit, tesselate leaves, stalked receptacles with male and neuter flowers distributed all over the interior and more or less flattened and flanged seeds, though they differ in their more or less sessile bistaminate male flowers and small

receptacles like the precocious axillary ones of *F. callicarpa*. Some recent collections of the late Mr. C. E. Carr suggest that in New Guinea there are species of Eusyce of even greater affinity with Synœcia, but I have not yet been able to classify them. *F. pumila* (Eusyce) looks, at first sight, like Synœcia but the restriction of the male flowers to a ring round the orifice and the structure of the perianth seem to forbid a close connection.

The species of Synœcia, like *F. callicarpa* and *F.* punctata, occupy one of the highest states of evolution in Ficus. They are climbers with specialised vegetative system and elaborate cauliflorous receptacles constructed on the principle of the two-phase development which gives the peduncle, collar and bractless body. In *F. apiocarpa, F. Scratchleyana* and *F. Bordenii* one finds the ordinary type of root-climber with unspecialised vegetative system and axillary receptacles. I have no hesitation in placing these species nearest to the stock from which Synœcia has sprung, and this conclusion is supported by the fact that *F. apiocarpa* and *F. Scratchleyana* have large sepals that are not, or scarcely, gamophyllous. *F. apiocarpa* I consider the most primitive in its membranous and almost colourless perianth, perhaps also in its lack of neuter flowers but it is impossible to decide whether this may not be a secondary feature through reduction or loss. *F. callicarpa* and *F. punctata* occupy the other end of the scale in having distinct bathyphylls and acrophylls borne on shoots of limited growth, stomatal pits, asymmetric blades, cauliflorous receptacles and small thickly gelatinous perianth segments. *F. tawaensis, F. dens-echini* and, perhaps also, *F. trachycoma* and *F. cataupi* occupy intermediate positions. *F. tawaensis* evidently combines bathyphylls and cauliflorous receptacles with symmetric leaves without stomatal pits whereas *F. dens-echini* combines symmetric leaves, axillary receptacles, rather large and thin perianth segments and, apparently, a lack of bathyphylls with the presence of stomatal pits, minute though they be. *F. trachycoma* and *F. cataupi* combine almost symmetric leaves and, apparently, axillary receptacles with stomatal pits and, probably, bathyphylls. It is not a little remarkable that the species should fall into such a graded series. Within the subgenus evolution has been mainly vegetative.

Distribution

Synœcia must have evolved in the centre of the Malaysian region, taking this term in its widest sense, and it may be said to have exceeded its limits only in Formosa. Lower Burma, Siam, (Indo-China), Formosa, New Guinea,

Distribution of the Species of Synœcia

	Formosa	Indo-China	Tenasserim	Siam	Philippines	Sumatra	Malaya	N. Borneo	S. Borneo	Java	Celebes	Moluccas	Timor	New Guinea
F. callicarpa typical	..	..	+	+	..	+	+	..	+	+	?	..	..	..
parvifolia	+	?	..	..	+	..	..	+	..	..	+	+	+	..
angustifolia	..	..	..	..	+	..	+	+	..	..	..	..	..	..
crassinervia	..	..	..	..	..	+	+	..	+	..	..	..	..	..
multinervia	..	..	..	..	..	+	..	..	..	..	..	..	..	..
F. punctata ..	..	..	..	..	..	+	+	..	+	+	..	..	..	..
F. trachycoma ..	..	..	..	..	..	..	..	..	..	+	..	..	..	..
F. apiocarpa ..	..	..	..	..	..	+	+	..	+	..	..	..	..	..
F. Bordenii ..	..	..	..	..	+	..	..	..	..	..	..	..	..	..
F. cataupi ..	..	..	..	..	+	..	..	..	..	..	..	..	..	..
F. Scratchleyana ..	..	..	..	..	+	..	..	..	..	..	..	..	..	+
F. tawaensis ..	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. dens-echini ..	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. Carri ..	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. barba-jovis ..	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. tulipifera ..	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. grandiflora ..	..	..	..	..	..	..	..	+	..	..	..	..	..	..
F. Simiae? ..	..	..	..	..	..	..	..	..	+	..	..	..	..	..
F. singalana? ..	..	..	..	..	..	+	..	..	..	..	..	..	..	..
	1	1?	1	1	5	6	5	8	5	3	1	1	1	1

Timor and Sumatra mark the boundaries of the species, so far as they are known. None has been found in Peninsular or Himalayan India, Ceylon, the Andaman and Nicobar Islands, S. China, Queensland or the Pacific Islands. Such confinement is remarkable, unlike any other subgenus or natural group of Ficus, and I am inclined to think that it is caused primarily by the lack of seed-dispersal by animals (p. 87) and secondarily by the late evolution of the species, for why else, should *F. variegata* range unaltered from Assam to the Philippines and Hongkong to Java, while *F. callicarpa,* which commonly grows on *F. variegata* in Malaya and is equally at home in cultivation, is split up over the same area into a number of restricted varieties? Still more remarkable is the distribution of the individual species. It must be realised, however, that more intensive collecting will add greatly to our knowledge of the distribution of species, for instance in Sumatra, Borneo, Celebes, Timor and Flores, but one cannot wholly ignore the evidence of the last hundred years and I would lay stress on the recent work of Mr. Carr in Borneo and New Guinea. Mr. Carr had exceptional ability as a collector as I know from our joint expeditions in Malaya and Sumatra. In the neighbourhood of Mt. Kinabalu in Borneo for 7 months, and of Port Moresby and Mt. Victoria in Papua for 18 months, Mr. Carr searched specially for the wild figs and obtained very rich collections as his 4 new species of Syncœcia from Kinabalu will testify. In Papua, moreover, he purposely had trees felled or climbed every day while he was in the forest so that he could obtain a representative collection of high trees, big climbers and epiphytes which others had been unable to reach. When, therefore, common species are not represented in his collections, one may reasonably conclude that they are absent from the area in which he collected and not that he had overlooked them, especially too, when Syncœcias fruit at most times of the year and Mr. Carr spent several months on his collecting trips.

By far the richest development of Syncœcia is in Borneo, where 9 species and 3 varieties have been found out of the total of 13 species and 4 varieties. (I have excluded *F. Simiae* and *F. singalana* from this discussion because they are doubtful). Six of these species appear endemic on or in the neighbourhood of Mt. Kinabalu, namely *F. tawaensis, F. Carri, F. dens-echini, F. barba-jovis, F. tulipifera* and *F. grandiflora,* but our knowledge of the Bornean flora is clearly too meagre for a definite statement and it is likely that more novelties will be discovered. It will be seen from the Table that, so far as is known, the Northern part of Borneo contains different species from the Southern. *F. apiocarpa, F. callicarpa* (*typica* and *crassinervia*) and *F.*

punctata were absent from both Mr. Carr's and the Clemens's collection from Kinabalu as well as from Elmer's in the neighbourhood of Sandakan.

Of the species that occur in S. Borneo, *F. callicarpa crassinervia* and *F. apiocarpa* occur in Malaya and Sumatra, while *F. callicarpa typica* and *F. punctata* are found in Java as well, but none of these reach to the islands north and east of Borneo so that one suspects that they have been distributed over the southern part of the Sunda-shelf. In contrast, *F. callicarpa parvifolia* and *F. callicarpa angustifolia* suggest a northerly distribution. One may say that *F. callicarpa typica* occupies the inner, southerly and westerly part of the Sunda-shelf and *F. callicarpa parvifolia* the outer northerly and easterly part without, apparently any overlap, unless it is to be discovered in N. Borneo and Siam.

After Borneo, come next in importance the Philippines with three species, *F. Bordenii, F. cataupi* and *F. Scratchleyana* and two varieties of *F. callicarpa.* The first two species are apparently endemic, the third is flung out to New Guinea presumably with some unknown connection in Ceram or the Moluccas, if not in Borneo and Celebes. (I am inclined to regard *F. Scratchleyana* as the eastern counterpart of *F. apiocarpa*). One finds, that is, the endemism of North Borneo in the adjacent Philippines. The only other endemic Syncœcia is *F. trachycoma* of Java.

After the Philippines come Sumatra and Malaya with a very similar content, as one would expect from their proximity. Malaya has some connection with the Philippines and N. Borneo in *F. callicarpa angustifolia* but Sumatra has none. The affinity of the two countries is mainly with S. Borneo and Java.

In Java there are three species, *F. callicarpa, F. punctata* and *F. trachycoma,* the distribution of which lies strictly on the Sunda-shelf. It is strange that *F. apiocarpa* should be absent, though one cannot doubt the fact because it could not have been overlooked by the early botanists who collected before the lowland forest had disappeared.

The remaining countries Formosa, Tennasserim, Siam, Celebes, Moluccas, Timor and New Guinea contain but one species each, the distribution of which is a natural extension of its range from the centre of Malaysia. Whether a Syncœcia occurs in Indo-China, I am uncertain because Gagnepain's description of *F. punctata* (Fl. Gen. de l'Indochine, V) suggests something quite different, perhaps Eusyce. The only record of a Syncœcia from New Guinea is the type of *F. Scratchleyana,* presumably from Mount Scratchley. There can be no doubt that New Guinea, like

Burma, Formosa and Timor, lies at the very limit of distribution of the subgenus. The big collections which have been made this century in Dutch New Guinea have revealed no species nor has the big collection of Mr. C. E. Carr in Papua, through the Ficus-material of which I have purposely looked.

As for its altitudinal range, Synœcia belongs pre-eminently to the plains and lower mountain slopes. *F. apiocarpa* seems to be the one true lowland species, the others ranging from sea level to 1700 m.

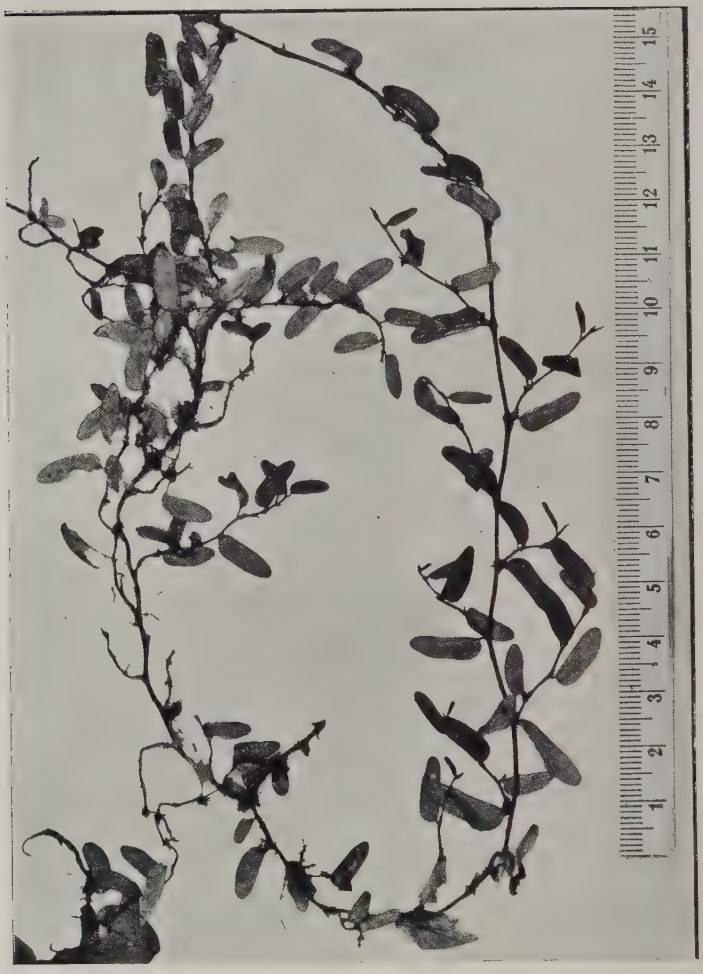
One must conclude that Synœcia has evolved in Borneo. Three species which I consider primitive occur there, namely *F. apiocarpa, F. tawaensis* and *F. dens-echini* while the two others, *F. Bordenii* and *F. Scratchleyana,* occur so near that I expect they will also be found in North Borneo. Indeed, it may well be that every species occurs in Borneo, outside of which Synœcia may have no endemism. The most wide spread species is *F. callicarpa* which, in apparent contradiction to the theory of Age and Area, I hold to be, with *F. punctata,* the most highly developed, and neither the typical state nor any variety of *F. callicarpa* shows a distribution covering the whole range of the species. Evidently the parent species has disappeared and there remain only the widening 'wheels' of the varieties that it has 'dropped'. In greater detail one may not argue until more collections come to hand.

In climatic respect, it seems that all species belong to the rain-forest rather than the monsoon-forest, though *F. callicarpa parvifolia* may be a climatic variety in the more seasonal parts of Malaysia.

The Identity of *F. falcata* Thunb. and *F. punctata* Thunb.

When I had discovered the variation of *F. callicarpa* and the ease with which its bathyphylls might be mistaken for *F. punctata,* I determined to find out the exact identity of *F. falcata* and *F. punctata.* Both species were described from Java where, according to recent collections, both *F. punctata* and *F. callicarpa* occur. The solution of the problem is at once evident from the photographs of the type of each species, (Plates 3, 4), because they clearly represent the bathyphylls and the leaves intermediate between the bathyphylls and the acrophylls of the Javanese species which has always been identified as *F. punctata. F. falcata* represents the bathyphylls and, as it has always been reduced to *F. punctata,* the name may rest forgotten in synonymy. For these photographs I am greatly indebted to Prof. N. E. Svedelius as well as for his confirmation of the identity of Thunberg's two species by comparison with specimens typical of *F. punctata, F. callicarpa* and its

Type-specimen of *Ficus punctata* Thunb., ex herb. Thunb., Uppsala: (photogr. by C. G. Alm, 1937: by courtesy of Prof. N. E. Svedelius, Uppsala).



Type-specimen of *Ficus falcata* Thunb., ex herb. Thunb., Uppsala: (photogr. by C. G. Alm, 1937, by courtesy of Prof. N. E. Svedelius, Uppsala).

varieties, which I sent for the purpose. Prof. Svedelius writes that both Thunberg's specimens are sterile so that the possibility of Thunberg's species being my *F. callicarpa* var. *angustifolia* can be excluded only on the grounds of plant-geography: in the numerous collections of Synœcia from Java this variety of *F. callicarpa* is not represented.

Subgenus SYNŒCIA

Dioecious root-climbers, commonly with bathyphylls.

Leaves rather thick and leathery, *tesselate beneath, in many species with hairy stomatal pits.*

Receptacles large to gigantic, seldom less than 3 cm. wide, with a peduncle, a collar of three basal bracts and no lateral bracts, *ripening vivid yellow, pink, orange or red and finally purple-black,* in a few species brownish, commonly marbled with paler spots, *containing either male and gall-flowers or female and neuter flowers* (no neuters in *F. apiocarpa*).

Flowers generally large and long-stalked: perianth of 3–6 separate or more or less gamophyllous, thickly gelatinous, wine-red pieces, rarely absent (*F. punctata*-forms) or colourless and membranous (*F. apiocarpa*): *all kinds of flower distributed throughout the receptacle.*

Male flowers with a very long white stalk, a gamophyllous perianth and a single stamen, overtopping the gall-flowers in the ripe receptacle.

Female flowers with a long style, bifid at the apex with a long and short arm.

Neuter flowers like sterile male-flowers, overtopping the female flowers in the ripe receptacle (except in *F. Carri*).

Seeds typically ellipsoid, flattened, with a narrow flange all round the body (? except *F. Carri*): embryo straight.

Burma, Formosa, ? Indo-China, Malay Peninsula and Archipelago.

NATURAL CLASSIFICATION OF SYNŒCIA

Division 1

Leaves without stomatal pits, scarcely or not asymmetric: bathyphylls absent (except *F. tawaensis*): receptacles axillary (except *F. tawaensis*)

Group 1

Bathyphylls absent: leaf-blade large, glabrous: petioles stout: receptacles glabrous, or sparsely hairy, marbled with pale spots, axillary (? in *F. Bordenii*)

A—Lateral veins 3–5 pairs: internal bristles absent or sparse: perianth of thin, irregularly denticulate, not gelatinous, white or pale pink segments: neuter flowers absent .. .. *F. apiocarpa*

AA—Lateral veins 6–9 pairs: internal bristles present: perianth of wine-red, entire, rather thick, gelatinous segments: neuter flowers present (? in *F. Bordenii*)

B—Leaf-base shallowly cordate: petiole 1–2 cm. long; male flower 12–17 mm. long, with gamophyllous perianth .. .. .. *F. Bordenii*

BB—Leaf-base not cordate: petiole 2–6 cm. long: male flowers smaller: the perianth of male and neuter flowers with 3 separate pieces .. *F. Scratchleyana*

Group 2

Bathyphylls present: leaf-blade small (up to 6 × 3 cm.), persistently hairy beneath, the base deeply cordate: petiole small: receptacles cauliflorous, persistently villous, not marbled .. .. *F. tawaensis*

Division 2

Leaves with stomatal pits, large, symmetric, the base equally cordate: bathyphylls ?: receptacles axillary, glabrous, marbled, broadly umbonate: internal bristles absent: female flowers very large, up to 16 mm. long; female ovary sessile: perianth of neuter-flowers with free or only slightly joined segments .. .. *F. dens-echini*

Division 3

Leaves with stomatal pits, more or less distinctly asymmetric: bathyphylls present: receptacles in most species cauliflorous: internal bristles present: female flowers not above 11 mm. long: perianth of neuter flowers gamophyllous

Group 1

Receptacles more or less glabrous at maturity, marbled with paler spots or pimples, generally not umbonate in the fresh state (often so when dried)

A—Leaf-blade more or less scabrid, with acute or acuminate apex, often almost symmetric: receptacles axillary

B—Blade broadly elliptic, up to 6.5 cm. wide: lateral veins 7–10 prs. very slightly raised on the underside of the blade .. .. *F. trachycoma*

BB—Blade narrowly elliptic, up to 3.6 cm. wide: lateral veins 5–7 prs., strongly raised on the underside of the blade .. .. .. *F. cataupi*

AA—Leaves not scabrid: receptacles cauliflorous

B—Male and gall-flowers with stout pedicels 1–2 mm. thick: gall-flowers with long pedicels and sessile ovaries wholly embraced by the 4–6 stout, often joined, perianth-segments: leaf shortly acuminate, nearly or quite symmetrical .. *F. grandiflora*

BB—Pedicels of male flowers slender, less than .5 mm. wide: gall-flowers

sessile or with short pedicels and a more or less stalked ovary, not or scarcely embraced by the perianth-segments

C—Perianth-segments of gall-flowers narrowly gamophyllous at the base: leaf-blade small, elliptic-lanceolate with acute apex: lateral veins 8–11 pairs, prominent beneath . . *F. tulipifera*

CC—Perianth-segments of gall-flowers free: blade very variable, with blunt or subacute apex and generally fewer lateral veins . . . . *F. callicarpa*

Group 2

Receptacles persistently and densely villous, generally umbonate in the fresh state, not marbled

A—Leaves very large and coriaceous, the blade about 17 × 7 cm., strongly acuminate, slightly inequilateral: lateral veins 7–10 pairs, very prominent beneath: petiole large, 3–4 cm. long: orifice of the receptacle deeply sunken: flowers very large: neuter flowers variable in length . . . . *F. Carri*

AA—Leaves much smaller, the blade less than 10 cm. long, not acuminate, distinctly inequilateral: petiole small, less than 1 cm. long: orifice of receptacle not or scarcely sunken: flowers not so large: neuter flowers of fairly constant length

B—Leaf-blade scabrid, strongly asymmetric with acute apex and very unequal base, cordate-auricled on one side, with glabrous stomatal pits: lateral veins 6–9 pairs, prominent and broad beneath: orifice of receptacle incompletely closed by the apical scales . . *F. barba-jovis*

BB—Blade smooth, not so strongly asymmetric, blunt, not auricled, with hairy stomatal pits: lateral veins 3–5 pairs, scarcely prominent fine: orifice of receptacles slightly sunken, effectively closed by the apical scales . . . . . *F. punctata*

KEY TO THE SPECIES OF SYNŒCIA

Leaves simply tesselate beneath, without stomatal pits

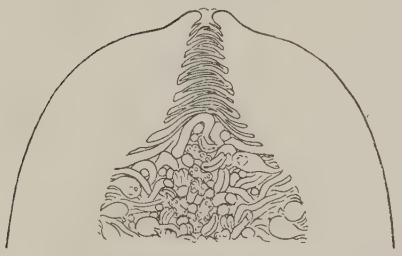
Blade rather small, up to 6 × 3 cm., persistently hairy beneath, deeply cordate: petiole short, slender . . . . *F. tawaensis*

Not so: blade medium to large, glabrous: petiole stout

Blade with 3–5 pairs of lateral veins, the lateral basal veins reaching ½–¾ the length of the blade . . . . *F. apiocarpa*

Blade with 6–9 pairs of lateral veins
Leaf-base shallowly cordate: petiole 1–2 cm. long .. .. *F. Bordenii*
Leaf-base not cordate: petiole 2–6 cm. long .. .. .. *F. Scratchleyana*
Leaves tesselate on the underside with stomatal pits
Leaf-base more or less cordate, symmetric: stomatal pits very minute: petiole 4–10 cm. long: blade not scabrid .. .. *F. dens-echini*
Leaf-base cuneate or very asymmetrically cordate: petiole .5–4.5 cm.
Blade distinctly scabrid on the upperside: apex acute
Petiole .5–1.5 cm. long: blade almost symmetrical, ovate-elliptic: lateral veins rather faint on the underside *F. trachycoma*
Petiole .3–1 cm. long: blade more or less asymmetric: lateral veins strong on the underside
Base of blade strongly asymmetric, one side cordate-auricled *F. barba-jovis*
Base of blade slightly asymmetric *F. cataupi*
Blade not scabrid on the upperside
Blade acute
Petiole 2.5–4.5 cm. long: blade stiffly coriaceous with strong veins, 10–20 cm. long .. .. .. *F. Carri*
Petiole less than 2.5 cm. long
Petiole less than 1 cm. long: blade 1–3 cm. wide .. .. *F. tulipifera*
Petiole 1–2.5 cm. long: blade 4–7 cm. wide
Dried blade with the veins depressed on the upperside .. *F. callicarpa multinervia*
Veins slightly raised on the upperside .. .. *F. grandiflora*
Blade blunt, generally minute retuse, inclining to obovate
Blade 6–12 × 4–7.5 cm., scarcely asymmetric: petiole .5–2 cm. .. *F. callicarpa*
Blade up to 6 × 4 cm., more or less asymmetric and falcate: petiole up to 1 cm. long
Veins thick and prominent beneath, depressed on the upperside .. .. *F. callicarpa crassinervia*
Veins very fine, scarcely prominent beneath, not sunk above
Blade 1–4 cm. wide, elliptic to obovate; base slightly asymmetric .. *F. callicarpa parvifolia*
Blade 1–2 cm. wide, narrowly oblong elliptic, base distinctly asymmetric

Receptacles glabrous and marbled	..	*F. callicarpa angustifolia*
Receptacles villous, not marbled	..	*F. punctata*



Text-Fig. 1 *F. apiocarpa:* section through the orifice of the gall-receptacle, × 1½.

F. apiocarpa Miq.

Fl. Ind. Bat. Suppl. I. *1860–62,* p. 440.

Text Figs 1–4, 8, 37.

A big climber with a rather thin stem (up to 5 cm. thick), reaching 20–40 m. long; the low creeping stems rooting in the ground, *without bathyphylls.*

Stipules, young petioles and receptacles, and the underside of the main veins of the leaf varying sparsely hairy with short, pale brown, rather stiff, more or less adpressed hairs to softly downy with fairly close, short, white, spreading hairs: mature parts glabrous: in some cases the young parts also glabrous.

Leaves laxly spiral or apparently alternate on the hanging shoots: *blade* 10–34 × 4–13.5 cm., *large, elliptic, oblong or ovate, the base varying cuneate to distinctly though shallowly cordate, the apex more or less acuminate with a blunt or subacute tip* 5–20 mm. long, *nearly or quite symmetric,* coriaceous-chartaceous, rather thick, smooth, shining dark green, the underside pale green with a dark green reticulum of venules, drying yellowish to greyish green on the upperside and brown or greyish on the underside: *edge* entire or slightly sinuate, incurled in dried specimens: *primary lateral veins* 3–5 (–6) pairs, distinctly inarching near the margin, making an angle of 40–60° with the midrib, prominent beneath: *secondary lateral veins* scarcely prominent, irregularly transverse: *tertiary veins* distinct, not raised, commonly minutely tuberculate and enclosing more or less rectangular brown meshes (in dried specimens): *stomatal pits none: basal veins* 3(–5) *the outer two reaching* $^1/_3$–$^3/_4$ *the length of the blade* and making an angle of 30–40° with the midrib: *petiole* 1.5–

7.3 × .3–.4 cm., *long, stout,* brown, flaky in dried specimens: *stipules* 6–20 mm. long: *leaves* on shoots creeping on the ground smaller and more pointed but in no way specialised.

Receptacles axillary on the leafy twigs, singly or in pairs, hanging, *generally with a very short peduncle, a long neck and an ellipsoid body,* with more or less umbonate apex, glabrous or sparsely adpressedly hairy on the peduncle, and round the orifice: *apple green becoming orange-scarlet and then purple-black, marbled with small,* .5–1.5 mm. wide, *innate pale spots,* the surface dull and slightly roughened with numerous lenticels, without papillæ: peduncle 1.5–13 mm. long, 4–5 mm. thick: basal bracts 1–2 mm. long, puberulous: neck 5–30 × 4 mm.: body 44–58 × 29–40 mm: *orifice* slightly depressed, small: *internal bristles absent or scarce and minute.*

Male flowers 9–17 mm. high, pedicel 5–9 mm. or less, glabrous, white: *perianth* 3–5 mm. long, *composed of four,* rarely three, linear, *irregularly and finely denticulate,* glabrous, *membranous segments white or very pale pink with deeper pink edges, joined to form a cup for* ¼–⅓ *of their length,* in some cases becoming irregularly dentate-ramified and anastomosing to form a reticulum with the adjacent flowers: *stamens,* rarely two, with a slender filament 2.5–5 mm. long and *a large anther* 2–3 mm. wide.

Gall-flowers 3.5–6 mm. high, *sessile: perianth composed of four,* rarely three or five, *linear, flat, glabrous, irregularly and finely denticulate, membranous segments* 3.5–6 mm. long, free or slightly joined at the base, *coloured as in the male flower* and in some cases dentate-anastomosing in the same way, simply attached: *ovary* 1.5–1.8 mm. wide, sessile or with a short stalk up to 2 mm. long, rather humped: *style* .5–1 mm. long.

Female flowers 4.5–6.5 mm. high, *sessile: perianth* as in the gall-flowers, the segments 3–4.5 mm. long: *ovary* sessile to long-stalked: *style* up to 4 mm. long, shortly bifid, glabrous: *seed* 2.2–2.8 mm. long, yellowish, as in *F. punctata.*

Neuter flowers absent.

Habitat: in lowland swampy forest and by streams and rivers to moderate altitudes.

Distribution: Malaya (common), Sumatra, Borneo (south).

Collections:—

MALAYA:—

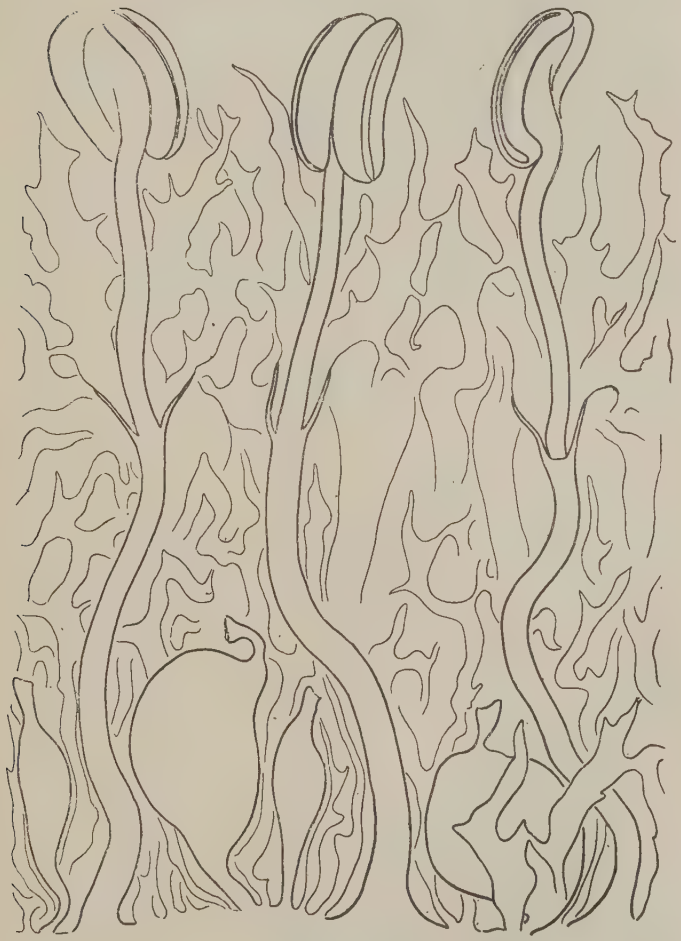
PENANG: Curtis 3508.

PERAK: Kunstler 4313, 5149, 6592, 10416, Scortechini s.n., Wray 1957, 2102.

MALACCA: Alvins 199, s.n. Malacca.

JOHORE: Corner 21186, 31463, Kiah 31957, Lake and Kelsall s.n. 1892, Ridley 1710.

SINGAPORE: Ridley 3400, 5614, 5615, 12562, s.n. 1892, s.n. 1894.
BANGKA: Teysmann 3237, 6855, 6871, 6372.
SUMATRA: Teysmann 796 (pr. Siboga).
BORNEO: Teysmann 7905 (Kapuas, S. Borneo).
PHILIPPINES: (No certain record: most specimens being *F. scratchleyana*).



Text-Fig. 2 *F. apiocarpa:* mature gall- and male flowers *in situ* with reticulate perianth segments, × 10.

This species is anomalous in several respects. Whether its features are primitive or have been derived by loss from the typical condition of the subgenus, it is impossible to decide but I am inclined to place it as the most primitive member on account of the lack of bathyphylls and stomatal pits to the leaves, of neuter flowers and of specialised, deeply coloured, gelatinous segments to the perianth as well as the axillary position of the receptacles. The large glabrous leaves with strongly ascending basal veins, the axillary figs with short peduncle and the almost colourless perianth are characteristic. With leaves only, care is needed to distinguish the species from *F. Scratchleyana*. It seems not to have been collected in recent years outside Malaya.

In some specimens perianth segments remain free but in others they become strongly anastomosed (Text Fig. 2). In these cases, when the flowers are full grown, the teeth of the perianth segments enlarge and apparently engage with those of adjacent segments, becoming stuck together so firmly that the flowers are embedded in a spongy mass and can be dissected only with the greatest difficulty, if at all.

F. apiocarpa has the same distribution as *F. callicarpa crassinervia*. The absence of both from Java is, I think, certain.

F. barba-jovis nov. spec.

Text-Figs. 5, 6, 35.

F. punctatae affinis: *lamina* 2–8.5 × .1–3.5 cm., *elliptica* vel elliptico-lanceolata, *valde inaequalis, falcata, basi unilateraliter cordato-auriculata, apice acuta,* subcoriacea, *scabrida, subtus plus minus pilosa, costis lateralibus utrinsecus 6–9,* subtus valde prominentibus, basalibus 4–5, *areolis foveolis glabris profundis praeditis:* petiolus 2–4 mm. longus.

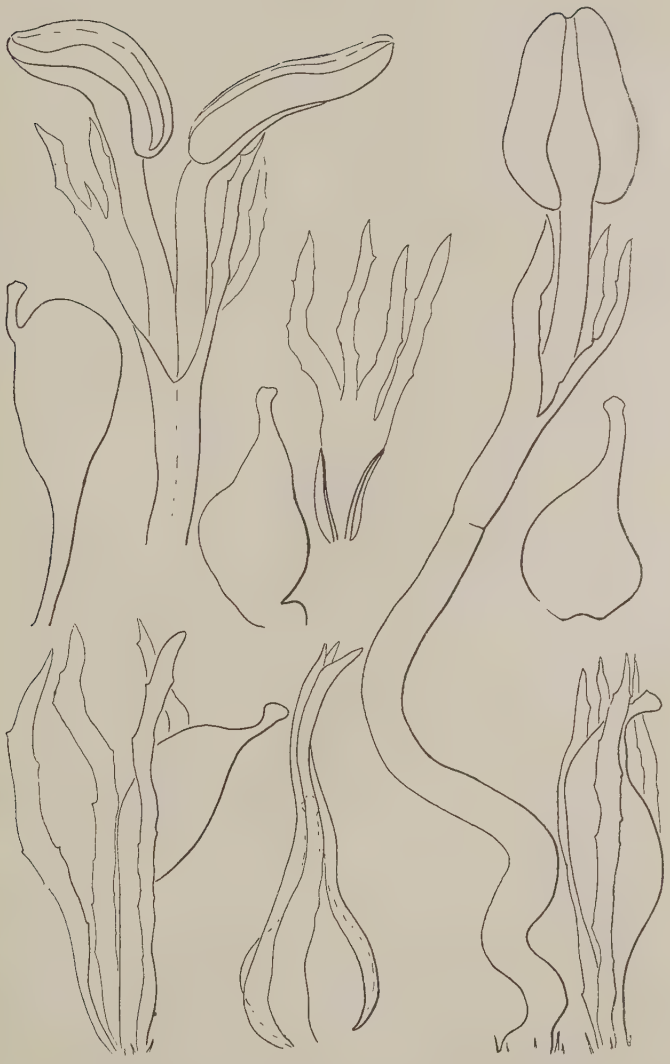
Receptaculum cauliflorum, ellipsoideum, 4.9 cm. latum, *pilis longis* (2–3 mm.) *brevibusque* (.5 mm.) *dense et molle albo-villosum, ostiolo profunde perforato.*

Distr. British North Borneo, ad Koung, pr. Mt. Kinabalu, alt. 500 m.

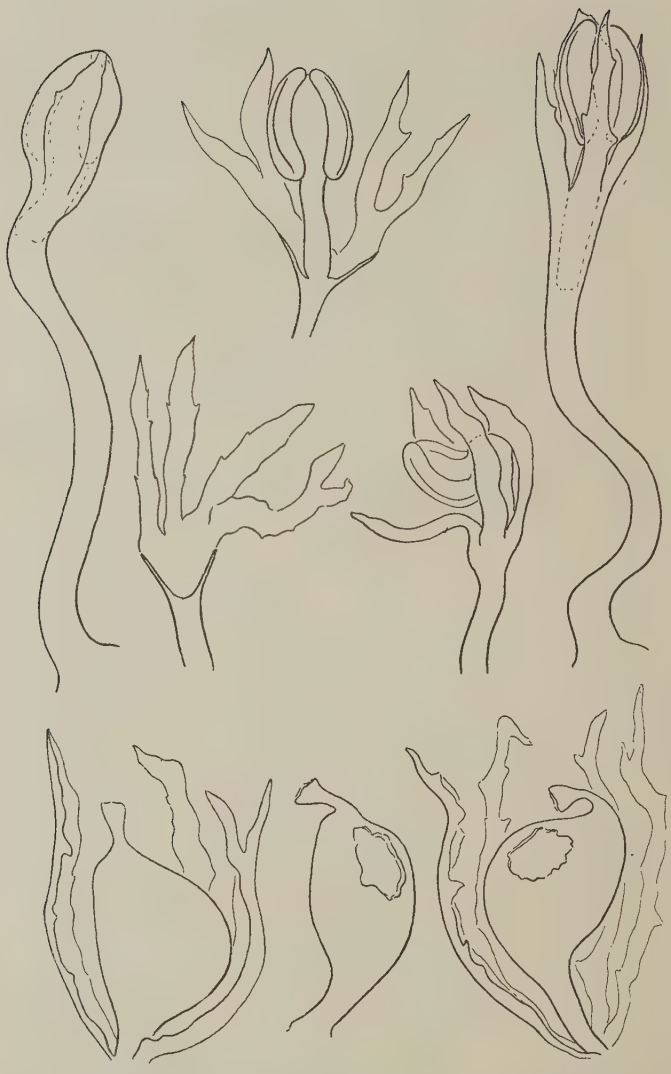
Typus:—S.F. No. 27305, leg. C. E. Carr, 13. 5. 33: "scrambling up a rock-cliff": spec. typ. in Herb. Sing.

Root-climber as *F. punctata:* stem up to 1 cm. thick: twigs slender.

Young twigs, petioles and leaf-blades rather sparsely hairy with lax white spreading hairs, 1–1.5 mm. long, the mature parts more or less glabrescent especially the upper-sides of the leaves, the undersides generally rather persistently hairy: stipules finely adpressedly pubescent.



Text-Fig. 3 *F. apiocarpa:* mature gall- and male flowers dissected. × 10.



Text-Fig. 4 *F. apiocarpa:* mature gall- and male flowers dissected, × 10.

Leaves alternate: *lamina* 2–8.5 × 1–3.5 cm., *elliptic* or elliptic lanceolate, *strongly asymmetric, falcate, tapered gradually to the narrow, sharp apex* (not acuminate nor retuse), subcoriaceous, *scabrid especially on the upperside* from the persistent and swollen bases of the hairs, drying greyish greenish or pale greyish brownish on the upperside, light fawn-brown on the underside, the midrib and main veins very faint on the upperside, in some cases slightly raised, in others slightly depressed: *edge* slightly incurved or plane in dried leaves, minutely denticulate especially towards the apex: *primary lateral veins* 6–9 pairs, arising at a wide angle of 70–80° from the midrib, inarching to form a conspicuous marginal vein 1–1.5 mm. from the edge, drying light brown and distinctly raised on the underside: *secondary and tertiary veins* scarcely raised, distinct, reticulate, *with deep, glabrous pits* in the meshes: *base very unequal, strongly cordate-auricled on one side,* the auricle as long as or longer than the petiole and often slightly overlapping the stem, cuneate or narrowly subcordate on the other side, with 4–5 basal veins: *petiole* 2–4 mm. long, 1 mm. wide, short, slender, becoming brown-scurfy in dried specimens: *stipules* 4–10 mm. long, lanceolate.

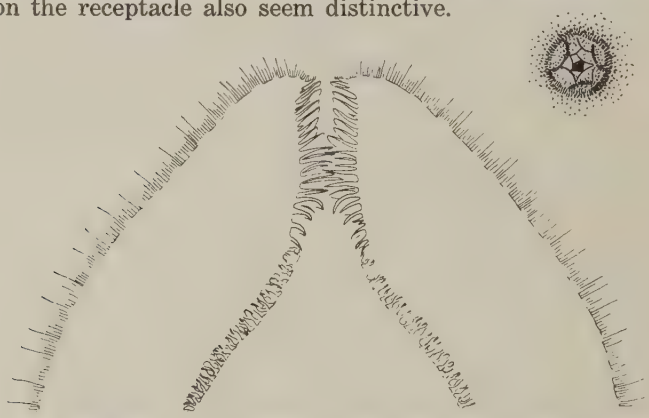
Receptacles solitary on short, woody bracteate tubercles on the stem, greyish green when young *becoming bright rose-pink* (? colour when ripe), *wholly villous: peduncle* 5 mm. long and wide, thick, densely hairy as the body: *basal bracts* 3, 5–6 mm. long, lanceolate triangular, acute, shortly and closely adpressedly hairy on the outside, closely adpressed to the body: *body* up to 7.2 × 4.9 cm., ellipsoid, rather narrowly barrel-shaped, slightly contracted near the apex but not truly umbonate, sessile on the peduncle without any neck, *wholly thickly and softly white hairy with long, looser hairs* (2–3 mm. long) *arising from a dense pile of short hairs* ca. .5 mm. long: *orifice* 3 mm. wide, flush with the surface, with three shortly villous marginal apical scales and *incompletely closed by the internal scales leaving a small central hole: internal* bristles not numerous, ca. .5 mm. long.

Male flowers with a wine-red subgelatinous perianth, gamophyllous for ½–⅔ its length, with three hooded lobes: stamen 1.

Gall-flowers sessile: *perianth* of 3–4 free, simple, entire, firmly gelatinous, wine-red segments, simply attached: stigma discoid, serrate.

I describe this species from dried twigs with small receptacles and from one large receptacle in spirit. In this specimen the flowers are still minute, though the gall-flowers are at their receptive stage. The structure of the flowers can readily be made out but I have not considered it worth

while to give any measurements. To what size the receptacles may reach, I do not know nor can I decide whether the leaves are bathyphylls or acrophylls. Nevertheless there can be no hesitation in naming such a striking species. It is distinguished by the large, thickly and softly villous, or lanuginous, receptacles with deeply perforate orifice and the small very asymmetric, scabrid leaves with semi-auricled base and very prominent main veins on the underside. The basal bracts of the receptacle also are longer than in any other species. The stomatal pits are not hairy but that may be because the leaves may be bathyphylls. The absence of a neck to the receptacle is, perhaps, specific but this feature is very variable in other species and the material is insufficient to decide. The two kinds of hair, long and short, on the receptacle also seem distinctive.



Text-Fig. 5 *F. barba-jovis:* section through a young gall-receptacle, × 2, the orificè × 3.

Text-Fig. 6 *F. barba-jovis:* young gall-flowers (at the receptive stage) and immature male flowers *in situ:* perianth-segments of gall-flowers in black: × 10.

The species is undoubtedly near *F. punctata*. Its leaves, however, are extraordinarily like those of *F. cataupi*.

F. Bordenii Merrill

Govt. Lab. Publ. Philip. 29, *1905*, p. 11.
Text-Figs. 7, 36.

A root-climber like *F. apiocarpa* with rather thick twigs drying light brown.

Stipules, young twigs, petioles and undersides of the leaves finely adpressedly hairy, becoming more or less glabrous: the underside of the midrib and main-veins with a few longer bristle-like hairs: *upperside of the leaves subscabrid* with small stiff hairs or their persistent bases, weathering smooth.

Leaf-blade 7.5–14 × 3–6 cm., *narrowly ovate*, symmetrical, tapered gradually to the shortly subacuminate, subacute apex, not retuse, *the base distinctly but shallowly cordate*, in some cases simply rounded, symmetrical *subcoriaceous*, dark green on the upperside, tesselate beneath, the edge entire or slightly uneven, *drying* light greyish greenish on the upperside with the veins showing as fine slightly raised lines, *rather silvery brownish on the lowerside with small brown spots in the reticulations: primary lateral veins* 6–9 pairs, arising at a rather acute angle, ca. 50°, inarching near the margin but without a distinct marginal vein, narrow and distinctly raised on the underside in dried leaves;: *secondary veins* subparallel but reticulate along the mid-line between the primary laterals, very slightly raised as fine lines on the underside of the dried leaf: *tertiary veins* reticulate, distinct but not raised, *without stomatal pits* in the areolæ though with brown spots: *basal veins* five: *petiole* 1–2 cm. × 2 mm., becoming brown scurfy or flaky: *stipules* 5–15 mm. long, lanceolate.

Receptacles (? position) finely and rather sparsely adpressedly puberulous, brown: *peduncle* 1–1.5 × .25 cm., adpressedly puberulous: *basal bracts* 3, 3–5 mm. long, lanceolate, rather spreading in the dried specimen, slightly puberulous: *body* apparently globose, 5–6 cm. wide without a neck: *orifice* 4 mm. wide, slightly projecting in the dried specimen and with numerous internal bracts projecting ca. 5 mm.: *internal bristles* abundant but short and inconspicuous.

Male flowers 12–17 mm. long overall, often with a linear wine-red bracteole (like a perianth-segment of the gall-flower) attached near the base of the stalk or half-way up: *perianth* 1.5–1.8 mm. long, wine-red, gamophyllous with three, occasionally two, apical lobes: *stamen* 4–5 mm. long overall: *anther* 1.5 mm. long.

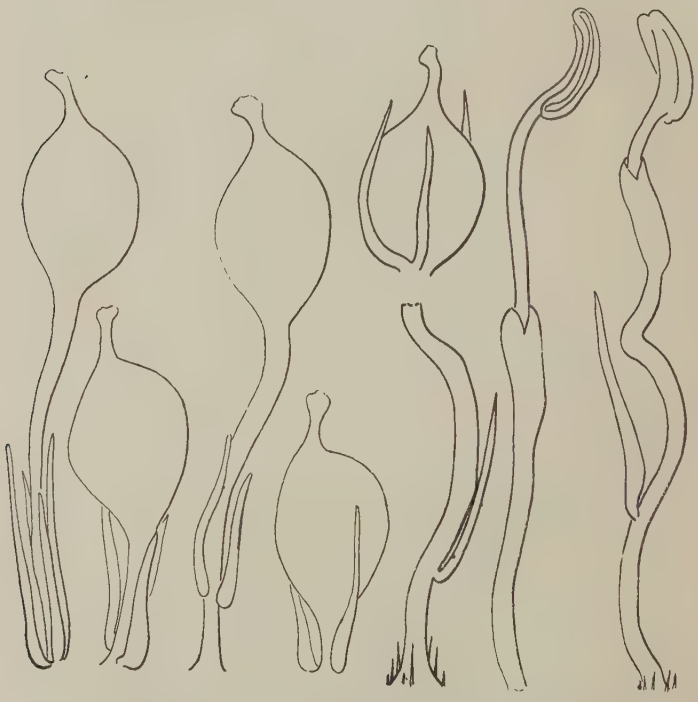
Gall-flowers 3.5–9 mm. long overall, sessile or with a short stalk up to 1 mm. long: *perianth* of 3–4 linear-lanceolate, entire, subgelatinous, wine-red segments 2–3.7 mm. long, occasionally two segments joined at the base, generally simply attached, in some cases peltate: *ovary* sessile or with a stalk up to 5.5 mm. long, the ovary itself 1.5–1.8 mm. wide: *style* .7–1 mm. long with a serrulate stigma.

Female and neuter flowers and seeds unknown.

Distr. Philippines.

Collections:—Philipp. For. Bur. 1211, leg. T.E. Borden, Lamao R., Luzon, ca. 650 m., June 1904, hill-forests (Type).

This species is known only from the type-collection. It is close to *F. dens-echini* which has larger, acuminate leaves with fewer veins rising at a much wider angle, stomatal pits and longer petioles. The receptacles seem also to differ in shape and structure of the orifice.



Text-Fig. 7 *F. Bordenii:* mature gall- and male flowers from the type-collection: × 10.

F. Bordenii is one of the simpler members of the subgenus.

F. callicarpa Miq.

Ann. Mus. Lugd. Bat. III, *1867,* p. 268, 289, t. 10 fig. A, B.

Text. Figs. 8–11, 30, 31.

Young shoots hairy with rather long white hairs, especially on the twigs and petioles and these with rather stiff adpressed hairs: the undersides of the leaves sparsely hairy: the uppersides nearly glabrous from the first: *all parts soon glabrescent,* except the persistently hairy peduncle, and edges of stipules and bracts.

Leaves alternate: *blade* 4.5–12 × 3–7.6 cm., *generally large, elliptic to subobovate,* gradually narrowed to apex and base, broadest about the middle, or above or below, slightly inaequilateral, inclining to subrhomboidal, coriaceous, glabrous, often slightly scabrid beneath, when fresh rather yellowish green above and shiny, *white-tesselate beneath,* with minute hairy pits, drying greyish or yellowish green above and greyish brownish beneath: *edges* entire, distinctly incurved in dried specimens: *apex* obtuse or subacute, rarely subacuminate, often minutely retuse; *primary lateral veins* 3–6 pairs, slightly raised on both sides of the dried leaf: *secondary lateral veins* faint, irregularly reticulate, *the areolae on the underside containing white hairy pits: base* rather strongly narrowed, rounded cuneate or minutely and narrowly cordate, equal or slightly cordate on one side, with three basal veins.

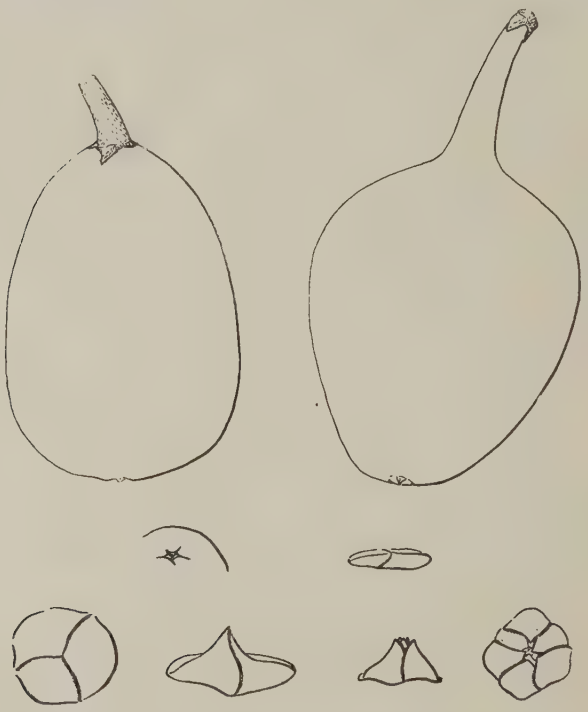
Petiole 5–20 × 1.5–2 mm, becoming brown flaky.

Stipules 5–13 mm. long, lanceolate acute, soon glabrous except for the ciliolate edges, generally caducous.

Bathyphylls: blade 1.5–5 × .2–1.2 cm, as the foliage leaves but narrower, more asymmetric, and thinner, generally strongly inaequilateral with the narrow side of the blade disposed acropetally, more or less falcate, the base often slightly cordate-auricled on one side: *primary lateral veins* 4–7 prs.: *petiole* 2–6 mm. long.

Receptacles borne as in *F. punctata* on woody tubercles up to 10 × 1 cm.; *massive, short or long stalked, obpyriform, ellipsoid or pyriform, smooth,* not umbonate or warted; puberulous round the orifice and very minutely scurfy with brown dots, in some cases finely and sparsely puberulous, *becoming glabrous, ripening brilliant orange to carrot-red and finally black, always marbled with paler elliptic transverse spots, some large 1–3 mm. long, and many smaller ones between the larger: peduncle* .2–2 cm. long × .3–4 cm. at the base and 4–7 mm. at the apex, slightly thickened

distally, usually with a small tumid band at the collar, for a long time puberulous with minute white adpressed bristly hairs, eventually dull orange: *basal bracts* 3–5 mm. long × 4–6 mm. wide, three in a collar, often grouped to one side of the peduncle, triangular acuminate, faintly keeled, adpressed, puberulous with bristly adpressed minute hairs especially on the keel, glabrescent, except along the edges; dull orange then blackening: *body* 4–10 × 3–8.5 cm, the neck 0–3 × .5–.8 cm.: *orifice* 3.5–6 mm. wide, rounded-angular, slightly depressed and *surrounded by a shallow groove, closed by 3–5 ± erect, acuminate, imbricate apical bracts forming an acute, projecting cone,* and similar to the basal bracts: *internal bristles* .1–.5 mm. long, abundant but very inconspicuous.



Text-Fig. 8 *F. callicarpa: above,* two extreme forms of receptacle, nat. size: *middle,* the orifice of the receptacle of *F. apiocarpa* (left) and of *F. punctata* (right) × 3: *below,* the orifice of the receptacle of *F. callicarpa,* × 3.

Female flowers 4–7 mm. high, sessile or with a short stalk up to 1.5 mm. long: *perianth of 3–4 free, lanceolate,* tumid, entire, glabrous *segments,* 1–3.5 mm. long, adpressed to the ovary and *with a minute peltate attachment,* in a whorl or arranged spirally: *ovary* sessile or with a stalk up to 2.5 mm. long: *style* 1–2.5 mm. long, subterminal, straight, with a bifid stigma, the arm projecting over the ovary longer than the other.

Neuter flowers 5.5–7 mm. high: *pedical* white, glabrous: *perianth* 1.5–2.5 mm. long, composed of 2–3, generally 3, linear-lanceolate or subspathulate, glabrous wine-red segments, free or united to the middle with the tips overlapping and often hooded but eventually separating and giving the shape of a crocus-flower: often with a sterile rod or abortive pistil inside the perianth, never a stamen.

Gall flowers 4.5–9 mm. high, sessile or shortly stalked: *perianth* as in the female flowers, but the segments 3–6 mm. long: *ovary* 2–2.5 mm. wide, ovoid, sessile or with a stalk to 5.5 mm. long, style .5–1.2 mm. long: stigma denticulate.

Male flowers 15–19 mm. long: *pedicel* glabrous, rather flexuous, white: *perianth* 2–2.5 mm. long, wine-red, gamophyllous, cleft for $\frac{1}{2}$–$\frac{1}{3}$ of its length into 2–3 subacute segments: stamen 2.5–7 mm. long, the anther just exsert at maturity.

Seeds 1.8–2 × .8 × .4 mm., strongly flattened, elliptic in outline with a faint hilum and prominent longitudinal flange round the body, smooth, straw yellow: embryo straight.

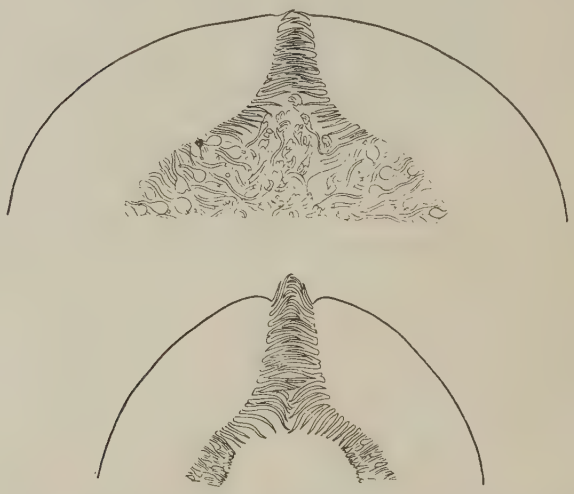
Hab.: in lowland forest, also to moderate altitudes (400 m.): common in villages and orchards.

Distribution:—Burma (Tenasserim), Peninsular Siam, Malaya, Sumatra, Java, Anamba and Natuna Islands, Borneo (South), Celebes? (Koorders 19180, Minahassa, with leaves exactly intermediate between *F. callicarpa typica* and *F.c.parvifolia*).

Collections:—

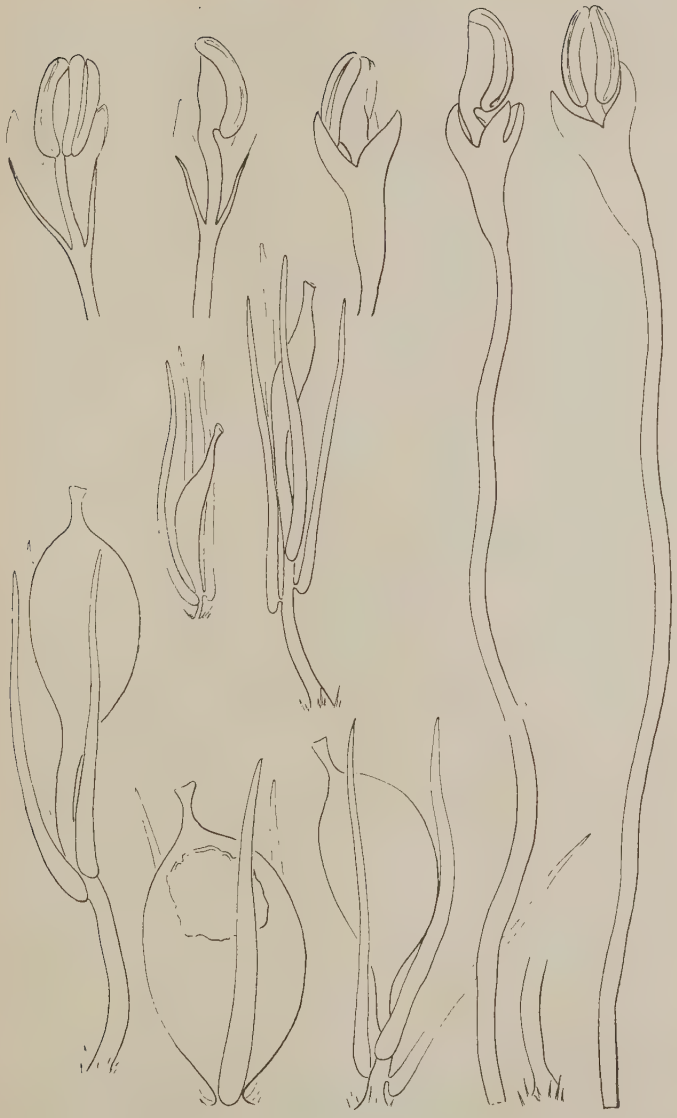
TENASSERIM: Falconer 1026 (Moulmein); Meebold 14517 (Maunglow), 14683 (Duriaan).
SIAM: Kiah 24354 (Kampengpet, L. Siam).
MALAYA:—
PENANG: Curtis 3507, s.n. 1892, Ridley s.n. 1898.
TRENGGANU: Corner 25835, 33489.
PERAK: Burkill 13982, 13988, Kunstler 147, 7949, Scortechini s.n., Wray 2022.
PAHANG: Burkill 17193, Henderson 21687 (P. Tioman), Ridley s.n., 20.8.89.
NEGRI SEMBILAN: Burkill 6429 (det. *F. aurantiaca*).
MALACCA: Alvins 986, Corner 26134, Goodenough 1370.
SINGAPORE: Bayliss s.n. 1894, Corner 28183, Ridley s.n. 1892, s.n. 1894.

SUMATRA:—
Achmad 866 (P. Simaloer), Bunnemeyer 1067 (Ophir district).
Forbes 3224 (R. Rawas), Lorzing 7258 (Sibolangit), Yates 1522 (Sibayak).
JAVA: Koorders 15443, 21380, 32238, 38045, Mousset 511.
BALI: Maier 291.
ANAMBA AND NATUNA ISLANDS: v. Steenis 865.
BORNEO: Teysmann 7906, 11311, 11512, (all from S. and S. W. Borneo).
CELEBES: Koorders 19180 (possibly *F. callicarpa* var. *parvifolia*).

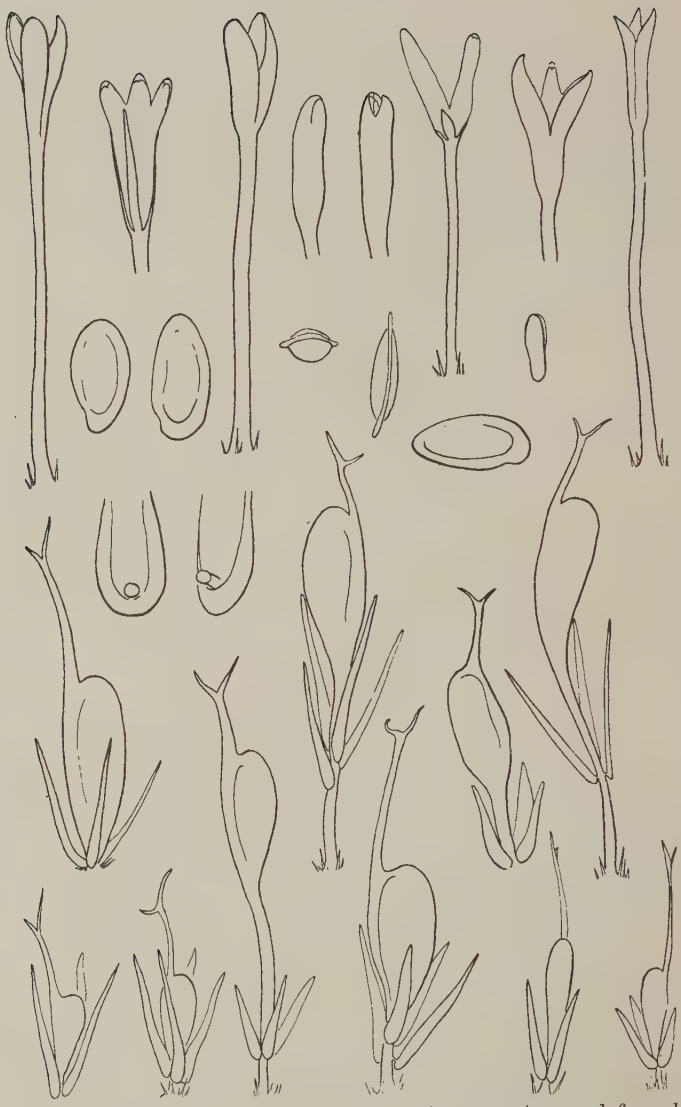


Text-Fig. 9 *F. callicarpa:* sections through immature (below) and mature gall-receptacles, × 1½.

This species appears limited, in its typical state, to the western and southwestern part of Malaysia. It has not been found west of Tenasserim or east of Celebes (if it really occurs in that island). It is a common species—— in Malaya the commonest Synœcia ——— and as it delights in climbing village trees, the extermination of lowland forest offers no barrier to its dispersal. It is not represented in the rich gathering of figs made by Mr. Carr on Mt. Kinabalu nor has it been found in the Philippines, where it can hardly have been overlooked. Why is this state, *F. callicarpa typica,* found in the South of Borneo and not in the North, in Java and not in India or Indo-China? It seems that its distribution is limited by a climatic barrier, to the north and east of which it is substituted by *F. callicarpa parvifolia.* That barrier may be the more prolonged



Text-Fig. 10 *F. callicarpa:* mature gall- and male flowers, × 10.



Text-Fig. 11 *F. callicarpa:* mature neuter and female flowers, with 5 seeds, an embryo and the bases of two perianth-segments from a female flower showing the peltate attachment (highly magn.): × 10.

influence of the dry monsoon. (The record of *F. callicarpa* from Timor, Forbes 3687, is really *F. callicarpa parvifolia*).

In making four varieties of *F. callicarpa*, I argue that when the receptacles and flowers have identical shape, structure and colouring, varying only in size, and the differences are merely in the leaves, in their size and shape, such differences have less than specific value. There is, indeed, evidence that plants occur intermediate between the varieties: collections of such I have mentioned under the varieties. The variability of *F. callicarpa* is not realised. As with *F. punctata*, there are great differences in the size of the flowers and in the degree of gamophylly in the male and neuter perianth but each collection, and presumably each plant, is constant in such features. I consider that *F. callicarpa* has evolved, or rather is still evolving, by producing more specialised vegetative conditions, particularly in the distinction between bathyphylls and acrophylls and in producing smaller leaves so that such states as var. *parvifolia* and var. *angustifolia* may have been derived from the typical state and this from *F. Simiae*. *F. callicarpa crassinervia* and *multinervia* have evolved for some reasons, doubtless connected with the climbing habit, peculiarly thickened veins. When they are better known, *F. trachycoma*, *F. cataupi* and *F. tulipifera* may be classified better as varieties of *F. callicarpa*, but many more collections of Syncœcia are needed especially from Sumatra, Borneo, Celebes, Timor and, perhaps, Flores, before a conclusion can be reached. The unsatisfactory distinction between *F. callicarpa* and *F. punctata*, I have discussed under that species.

According to King, the perianth of the male and neuter flowers is composed of three separate pieces but such is seldom the case, and his statement that the perianth of the female flower is composed of 1–2 pieces is also not true.

Gall-flowers are absent from the immediate neighbourhood of the orifice of the receptacle so that there are 2–3 rows of male flowers only, but there is no structural modification of the flowers near the orifice. In the seed-receptacles the female flowers next the orifice commonly have an abortive ovary or none at all and the neuter flowers are also reduced in size.

In Trengganu, I collected specimens of a gall-plant (S.F. No. 33489) which was remarkable in having very large pale receptacles. The body of the biggest measured 10×8.5 cm. (excluding the neck). The unripe body was green and very faintly marbled, then turned yellowish and became slightly flushed reddish or vinaceous as it ripened but never orange or scarlet nor purple black when fully

ripe. Such colouring is exceptional: c.f. *F. callicarpa angustifolia* (gall-figs).

KEY TO *F. PUNCTATA* AND *F. CALLICARPA*

Receptacles persistently and wholly villous Lamina small, elliptic-obovate to lanceolate-obovate with fine veins, 1.5–4.7 × .6–2.5 cm. ..	*F. punctata*
Receptacles glabrous, occasionally sparsely hairy when young	*F. callicarpa*
Veins of leaf thick and prominent on the underside, sunken or impressed on the upperside; lamina up to 6 × 3.5 cm.	*F. callicarpa crassinervia*
Veins fine, scarcely raised on the underside, not sunk on the upperside Lamina 5–12 × 3–7 cm., rather large ..	*F. callicarpa typica*
Lamina up to 6 × 4 cm. Lamina 1–4 cm. wide, elliptic to obovate, the base slightly asymmetric ..	*F. callicarpa parvifolia*
Lamina 1–2 cm. wide, narrowly oblong-elliptic, base distinctly asymmetric ..	*F. callicarpa angustifolia*

F. callicarpa var. **parvifolia** var. nov.

Text. Fig. 32.

Synonyms

F. megacarpa Merrill, Govt. Lab. Publ. (Philip.) 17, *1904*, 14.

F. terasoensis Hayata, Ic. Plant. Form. VIII, *1919*, p. 116, t. XV.

Lamina minor 1.8–6.2 × .7–4 cm., basi plerumque inæquilateralis uno latere cuneata altero anguste cordata, apici rotunda, obtusa, minute retusa: *petiolus brevior*, 1–10 × 1 mm.: *bathyphylla* breviora, ut in *F. punctata*, usque ad 2.4 × 1 cm.

Distr. Malaya, Indo-China?, Formosa, Philippines, Brit. N. Borneo, Celebes, Timor, Moluccas.

Other data:—

Leaves:—*blade* generally rather broadly elliptic, broadest at the middle, varying narrowly elliptic-oblong, elliptic-obovate or elliptic ovate, generally asymmetric, occasionally with symmetrical leaves on the free-hanging branches; *edges* of dried leaves in some cases rather strongly incurved: *base* occasionally symmetric and then rounded cuneate to shallowly cordate: *primary lateral veins* 3–5 prs., in dried leaves very faint above, slightly raised beneath, distinctly inarching near the margin: *basal veins* 2–4, often suppressed on the narrow side.

Receptacles often closely and finely villous when young as in *F. punctata*, becoming more or less glabrous and marbled.

Male flowers very variable in size, in different collections, 8–17 mm. long: *perianth* 1–2 mm. long, occasionally with 4 lobes: *stamens* up to 5 mm. long, very occasionally 2 stamens in each flower.

Gall flowers 4–13 mm. long, stalk up to 4 mm. long, *perianth* of 1–4, generally 3, segments 1.5–3 mm. long: ovary-stalk up to 9 mm. long.

Female flowers as in *F. callicarpa typica:* rarely only 2 perianth segments.

Neuter flowers 4–5 mm. high.

Seeds 2.2–3 mm. long.

Hab.: lowland and mountain forest to 1700 m.

Collections:—

PHILIPPINE ISLANDS: Barnes 322, Borden 222, Clemens 979, 9351, s.n. June 1907, Cuming 1927, Curran 10611, Edano 75892, Elmer 6102, 6757, 7471, 7506, 13932, 15393, 15613, Fenix 4104, For. Bur. 27876 (Palawan), Harder 5874, McGregor 10229, Merrill 782, Merritt 7759, Oro 30822, Ramos 13727, 14726, 16636, 80172, 80266, Robinson 9229, Sajor 31094, Villamil 20971, 21386, Wenzel 3161, Williams 559.

BORNEO: Carr 26492, 27761, Clemens 31336 (all from Mt. Kinabalu).

CELEBES: Koorders 19180 (this may be typical *F. callicarpa*), Kjellberg 2887.

TIMOR: Forbes 3687.

MOLUCCAS: Boerlage 315, Rant 131, Robinson 182.

FORMOSA: Sata 81 (Taiwan).

INDO-CHINA: (evidently the plants described as *F. punctata* in Fl. Gen. Indoch.).

That *F. megacarpa* is only a variety of *F. callicarpa* with smaller, rather differently shaped leaves is borne out by the fact that in some collections of *F. megacarpa* many of the leaves are so large as to pass for those of *F. callicarpa* and it is very difficult, if not impossible, to know how to classify such as Ramos 80266, Fenix 4104, Forbes 3687, Elmer 14726 and Koorders 19180; the first four of these I have decided to class with var. *parvifolia,* chiefly on grounds of distribution but Koorders' collection from Celebes may well be *F. callicarpa typica.* Moreover, the identification of bathyphylls and leaves of intermediate shape is very difficult, if not impossible, because the leaves of *F. megacarpa* which are intermediate between bathyphylls and acrophylls may be identical with the bathyphylls of *F. callicarpa,* e.g. Elmer 6102, Curran 10611. The receptacles and flowers of *F. megacarpa* are exactly similar to those of *F. callicarpa* and the trifling differences in size may disappear when a larger series of specimens is examined. Only, the seeds of *F. megacarpa* seem distinctly bigger. The identity of *F. terasoensis* has been established by Sata (5), and I have been able to examine a specimen

from Formosa. In choosing a name for this variety, which it is necessary to distinguish for geographical reasons in spite of the occurrence of intermediates, I have preferred one that will indicate its character rather than retain its first or second specific epithet, neither of which has significance.

If *F. punctata*, described by Gagnepain (Fl. Gen. Indochine, V, 813) is a Synœcia, it probably belongs to this variety. But the small receptacles (12–30 mm. long) with long stalks (6–50 mm. long) and the free sepals of the male flower suggest Sycidium, or Eusyce.

On the label of the type-specimen of *F. megacarpa*, it is noted "*F. megacarpa* Merr.= (*F. elliptica* Miq. non H.B.K.)" and on another sheet in the same cover is a small collection of leaves of Cuming 1927 on which *F. elliptica* Miq. is said to be based. These are identical with the leaves of *F. megacarpa*. But King cites this number under *F. disticha* so that I imagine Cuming's collection was mixed. King would surely not have referred such leaves, tesselate with stomatal pits, to *F. disticha*.

In distribution, *F. callicarpa parvifolia* occupies the central and northern part of western Malaysia, in the widest sense of the term. It overlaps the typical *F. callicarpa* only in Borneo and perhaps Celebes. It is remarkable that the typical state, so common in Malaya, should be absent from the Philippines and yet the species should be abundantly represented there by a variety which is absent from Malaya.

The young figs of this variety are usually rather closely hairy and, as they may retain their pubescence until more than half grown, they tend toward the hairy condition of *F. punctata*. Indeed, in reduction of leaf-size and in the incipient villosity of the receptacle, this var. *parvifolia* leads towards *F. punctata*.

F. callicarpa var. **crassinervia** var. nov.

Text. Fig. 33.

Lamina minor 2–6.2 × 1.1–3.6 cm., *elliptica vel ovata, lata, obtusa, inaequilateralis vel rhombica, basi valde asymmetrica uno latere profunde cordata vel saepe subauricalata.*

Lamina sicca, costa costaeque laterales magnae crassae, superne in lamina rugulosa plus minus profunde depressæ, inferne prominentes, fuscobrunneæ, longitudinaliter striatulæ, areolis magnis pilosis.

Distrib. Malay, Sumatra, Sarawak (pr. Kuching).

Typus. S.F.N. 28446 (Corner, Johore).

Other data:

Leaf: blade rather thin, occasionally symmetric, elliptic to elliptic-obovate with cuneate base on the free-hanging

twigs; primary lateral veins 3–7 pr., basal veins 3–5: petioles 3–10 × 1–1.5 mm.

Bathyphylls as in *F. callicarpa parvifolia* but with more conspicuous veins.

Female flowers: ovary-stalk to 4.5 mm. long, the flower up to 9 mm. long overall.

Hab. in lowland and mountain forest to 1200 m. occasionally in villages.

Collections:—
MALAYA:—
PENANG: Curtis s.n. 1892.
PERAK: Burkill 12795, Kunstler 7823, Ridley 14044, Wray 2231.
PAHANG: Corner s.n. 30.10.32, Siemund 591.
JOHORE: Corner 28446, s.n. 2.4.34, Down 133.
SINGAPORE: Ridley s.n. 1892.
SUMATRA: Jacobson 2190 (W. Coast), Postumus 678 (S. Manau, Djambi).
BORNEO: Hullett s.n. 19.7.90 (pr. Kuching, Sarawak).

Some collections of this variety were determined by King to be *F. punctata falcata* but King's "falcata" covers also the bathyphylls of *F. punctata, F. callicarpa* and *F. callicarpa parvifolia* and, being without typification, one must regard it as a "mixtum compositum". Var. *crassinervia* is clearly a further advance on var. *parvifolia* having leaves of similar shape and size but with strongly asymmetric base and curiously thickened, pronounced veins. Some collections of var. *parvifolia* from North Borneo have a slight thickening of the veins but they are not comparable with the Malayan and Sumatran specimens.

The distribution of var. *crassinervia* shows the close affinity of the floras of Sarawak, Malaya and Sumatra to the exclusion of Java, which country seems to have been separated on the Sunda-shelf before the other three and so to have missed many of the 'Kuching-Johore-Palembang' immigrants.

After *F. callicarpa typica,* this var. *crassinervia* is the next most abundant Syncœcia in Malaya. The closely adpressed bathyphylls, short leafy twigs with dark shiny foliage and the brilliant cauliflorous fruits make it an ivy-like creeper worthy of cultivation and far excelling *F. repens* in beauty.

F. callicarpa var. **multinervia** var. nov.

Text. Fig. 34.

Lamina major, 7–12 × 4–6.4 cm., elliptica, plus minus symmetrica, basi cuneata haud vel vix asymmetrica, *apice breve subacuta: costae laterales plures, utrinsecus 7–9.*

Distrb. Sumatra.

Typus: Lorzing 8397 (Sibolangit) in Herb. Hort. Bog.

Other data:—

Leafy twigs stout, as in *F. apiocarpa.*

Lamina as in *F. callicarpa crassinervia,* drying toast-brown on the upper side, grey brown beneath: midrib and main veins rather deeply impressed on the upperside, strongly raised on the lower side, inarching 2.3 mm. from the edge: petiole 1.5–2.5 cm. long: stipules 12–18 mm. long, glabrous.

Receptacles with large glabrous basal bracts, 4–6 mm. long, and no internal bristles.

Gall flowers (at the receptive stage) shortly stalked, with 4–5, rarely 3, perianth-segments, free or occasionally 2 segments joined at the base.

More collections of this variety are needed, particularly of mature receptacles, to discover if there are any marked floral differences from *F. callicarpa,* because it may well prove to be a distinct species. It resembles *F. tulipifera* closely, especially in the numerous veins and perianth-segments of the gall-flower, but it has larger leaves and glabrous parts. If it proves to be a distinct species, *F. tulipifera* may be a hairy variety with small leaves, with the possibility that *F. tulipifera* represents the bathyphylls.

The leaves of this variety are like those of *F. Carri* but not so large and coarsely veined: the receptacles, too, are different. But it is noteworthy that such similar leaves should occur in both the groups of my Division 3. The leaves of *F. grandiflora* are also very similar.

F. singalana King may be the same as this variety, though it is said to have only 4 pairs of side-veins.

F. callicarpa var. **angustifolia** var. nov.

Text-Figs. 12, 13, 33.

Lamina ut in *F. punctata,* 2.4–6.8 × .9–2.3 cm, anguste oblongo-elliptica vel subobovata, coriacea, symmetrica vel sæpe subfalcata, apice obtusa, basi attenuata, sæpe asymmetrica: costæ tenues, haud vel vix prominentes.

Receptacula cecidiophora saepe maxima (corpore 10–14 × 7.5–10 cm., pariete 1.2–1.7 cm. crasso), viridia dein *obscure aurantiaca* vel rubescentia vel rubro-brunnea, *maculata papillis pallidis* 1–3 mm. latis *subprominentibus, ostiolis valde depressis* (5–7 mm.): *receptacula feminea minora* (corpore usque 7.5 × 5 cm.), pallide maculata vix vel haud papillata, maculis 1–3 mm. latis, *laeta aurantia dein rubro-aurantia vel laete rubrobrunnea,* ostiolis 4–5 mm. depressis.

Distr. Malaya (common in the mountains of the main range), B.N. Borneo, Philippines (Luzon).

Typus:—S.F. No. 32969.

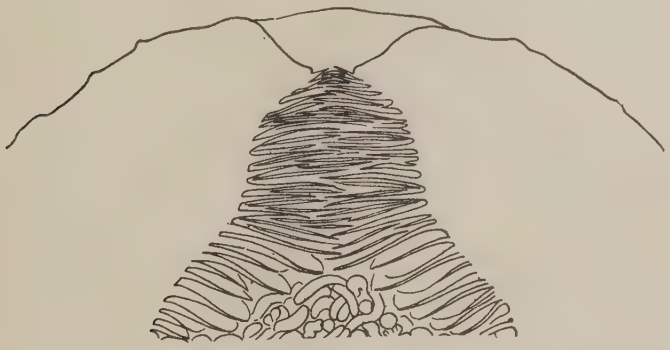
Collections:—
MALAYA:—
Nur 32969, Cameron Highlands, Pahang, ca. 1200 m., 2.5.37: gall-figs.
M. R. Henderson 23487, Cameron Highlands ca. 1500 m., 9.4.30: gall-figs.
Corner 33230 Fraser's Hill, Pahang, ca. 1200 m., 17.8.37, seed-figs: 33239, ibid., 19.8.37, gall-figs: 33242, ibid., 19.8.37, seed-figs: 33246, ibid., 20.8.37, seed-figs.
BORNEO: J. and M. S. Clemens 29315, Mt. Kinabalu, Tenompok, ca. 1600 m., 20.4.32: seed-figs (very young).
PHILIPPINES: G. Edâno 75892, Kamugong R., Camarines, Luzon, ca. 500 m., Oct. 1928 (det. *F. megacarpa*): seed-figs.

Other data:—

Male flowers 18–24 mm. long overall, long-stalked: *perianth* 2–2.5 mm. long, gamophyllous for ½–2/3 its length, with 3, rarely 2 or 4, lobes, wine-red: *stamen* 5–7 mm. long overall, the cream yellow anther 2–2.5 mm. long and far exsert.

Gall-flowers 4.5–15 mm. long overall, sessile or with a stalk 0–5 mm. long: *perianth* composed of 3–4, rarely 1, 2, or 5, linear, wine-red pieces separately and simply attached, 4–7 mm. long: *ovary* 2 mm. wide, sessile or with a stalk up to 6 mm. long: style 1.5–1.8 mm. long.

Female and *neuter flowers* 4–6 mm. high.

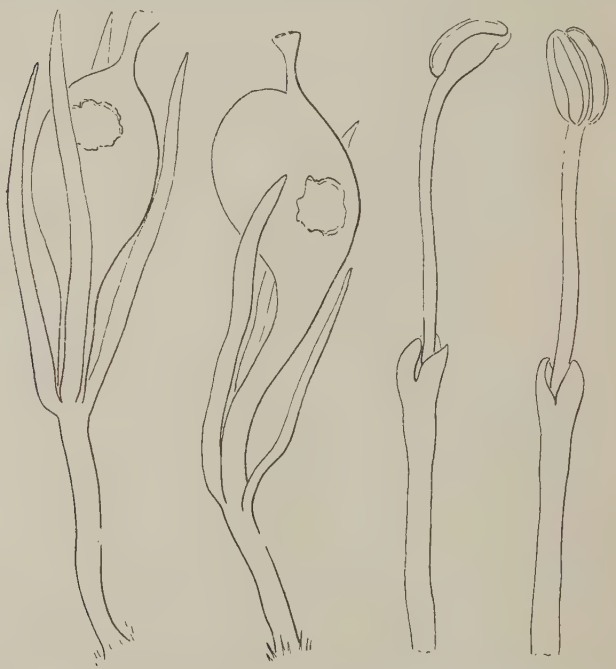


Text-Fig. 12 *F. callicarpa* var. *angustifolia:* section through a mature gall-receptacle (type-collection), × 2.

This variety is remarkable because it connects *F. callicarpa* with *F. punctata* and indeed it might well be made a glabrous variety of *F. punctata* because it differs from this species solely in its glabrous figs. It has small oblong subfalcate leaves with asymmetric base which are typical of *F. punctata,* though they are often a little larger and in the surface-structure of the fig it seems to be closer to *F.*

punctata than *F. callicarpa* despite the lack of hairs. It might even be made a new species on account of the very large, glabrous, papillate gall-figs. with their deeply sunken orifice and sombre colouring, but the seed-figs have the normal size, bright colour and pale innate or scarcely prominent spots typical of *F. callicarpa.* Moreover, the Trengganu-collection S.F. No. 33489, with leaves typical of *F. callicarpa,* has gall-figs similar in size and colour to those of *F. callicarpa angustifolia.* It is such cross-connection which makes the classification of the species into subdivisions so difficult, if not impossible, with our present imperfect knowledge. The variety *angustifolia* may well be a self-perpetuating hybrid between *F. callicarpa parvifolia* and *F. punctata.*

Between the gall- and seed-figs of this variety there is a distinct dimorphism both in size and colour, the gall-figs being much larger and more sombre, being equalled in size, in fact, only by those of *F. tawaensis.* I was able recently



Text-Fig. 13 *F. callicarpa* var *angustifolia:* gall- and male flowers, × 10.

to satisfy myself about this point at Fraser's Hill, Pahang, by means of my collecting monkey Merah (*Macacus nemestrina*). The variety is common in the hill-forest about 4,000 ft. and my monkey enjoyed itself by throwing down abundant figs from fourteen plants which we found fertile, five being gall-plants and the rest seed-plants. As I have remarked in the introduction, I believe such dimorphism is general in Synœcia though in few other cases so pronounced.

F. Carri nov. spec.

Text-Figs. 14, 15, 16, 36.

Lamina 10.5–21 × 4.8–9 cm., elliptica, elliptico-lanceolata vel ovato-lanceolata, sæpe paullum inæquilateralis et subfalcata, *coriacissima,* margine valde incurvata, apice acuminato triangulo .8–1.6 cm. longo, basi plus minus attenuata, *costa subtus valde prominenti, costis lateralibus utrinsecus* 6–10, *subtus valde prominentibus,* basalibus 3–6, *areolis piloso-foveolatis:* petiolus 2.5–4.5 cm. longus.

Receptaculum cauliflorum, vel axillare, ellipsoideum, 4–5 cm. crassum, *albo-villosum pilis subrigidis* .5–1.5 mm. longis, *ostiolo immerso: flores magni,* masculi 18–22 mm. longi, cecidiophori usque 13 mm. longi, feminei usque 11.5 mm. longi, *neutri variabiles* 4.2–9 mm. longi, cecidiophori et feminei sessiles sed ovario stipitato: *flores feminei stigmatibus indivisis vel 2–3 fissis, variabiles.*

Distr. British North Borneo, Mt. Kinabalu, 1200–1700 m. alt.

Typus: Sing. F. No. 27839, leg. C. E. Carr, Bundu Tuhan, 1500 m., 21.7.33, (gall): spec. typ. in Herb. Sing.

Paratypus: S.F. No. 26699, Menetendok-Kinataki divide, 1200 m., leg. C.E.Carr, 22.3.33 (female): J. and M. S. Clemens 29666, Tenompok, 1700 m., 10.5.32 (gall), quoad spec. in Herb. Sing.

Large root-climber with greyish white woody stems up to 2 cm. thick, with small slightly transverse pustulate lenticels: leafy twigs rather lax, stout.

Mature vegetative shoots mostly glabrous: stipules and twigs finely adpressedly puberulous, the twigs soon glabrous: *the underside of the lamina sparsely hairy with lax flexuous erect white hairs* 1–2 mm. long: the petiole and upperside of the leaf glabrous: *peduncles and receptacles thickly velvety with rather stiff white hairs* .5–1.5 mm. long.

Leaves alternate: *lamina* 10.5–21 × 4.8–9 cm., *large,* narrowly elliptic to elliptic lanceolate or ovate lanceolate, generally slightly inequilateral and curved, thick, *very coriaceous,* in the living state dark olive green above, pale green beneath with darker reticulation, *drying fawn-brown or brownish buff on both sides with the veins darker brown*

beneath, the veins strongly raised beneath, sunk in fine grooves on the upperside: edge strongly incurved (in dried leaves), generally minutely denticulate towards the apex or faintly serrulate, in some cases almost entire: *apex generally rather suddenly contracted and acuminate with a subacute, stout, triangular tip* .8–1.6 cm. long, not retuse: *base* of lamina gradually or rather suddenly narrowed, in a few cases equal and cuneate, generally distinctly but slightly inequilateral and narrowly subcordate on one side, not auricled (in one leaf broadly truncate-subcordate and slightly inequilateral): *midrib very stout and strong right to the tip on the underside: primary lateral veins* 6–10 pairs, arising at an angle of 65–80° from the midrib, incurving near the margin and *connected by a strong arching marginal vein* looping at 1.5–2 mm. from the edge, on the underside finely longitudinally rugulose as the midrib: *secondary veins* as fine grooves on the upperside, distinctly raised on the lowerside, reticulate: *tertiary veins* mostly as fine grooves on the upperside, scarcely raised on the underside, rather broad, *reticulate with rather large hairy pits in the meshes,* in many cases the reticulations finely brown-dotted: *basal veins* 3–6, variable: *petiole* 2.5–4.8 cm. long, .25–.35 cm. wide, stout, finely brown-scurfy flaky then glabrous, finely rugulose, blackish brown (dried): *stipules* 8–15 mm. long, lanceolate.

Bathyphylls?

Receptacles on short woody bracteate tubercles or in the axils of the leaves, singly or in pairs: *peduncle* 2–3 mm. long, 5.5 mm. wide, short stout, hairy as the body: *basal bracts* 3, 3–4 mm. long, triangular, subacute with broad slightly overlapping bases, finely adpressedly pubescent, spreading in the dried specimens but evidently adpressed in the living (i.e. alc. spec.): *body* up to 7.5 × 5 cm., ellipsoid, barrel-shaped, not umbonate, with a distinct neck 10–14 × 5 mm., *wholly white villous with very crowded rather stiff white hairs* up to 1.5 mm. long, *green turning olive-brown then brownish purple and white hairy: orifice* 2–3 mm. wide, *deeply sunken* to 4 mm. at the bottom of a narrow pit opening by 5 grooves at the surface, apical bracts invisible from above: *internal bristles* rather scarce, up to 1 mm. long.

Male flowers 18–22 mm. long (when straightened), *very long:* pedicel flexuous, often much curved, white: *perianth* 1.6–2 mm. long, *wine-red,* subgelatinous, *gamophyllous for a half to two thirds of its length,* with subacute lobes: stamen 1, 5–6 mm. long, the anther 1.5 mm. long.

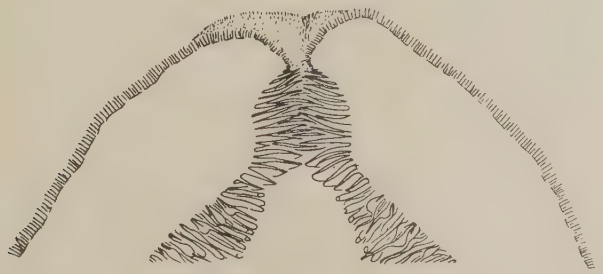
Gall-flowers 3.5–13 mm. long, *sessile: perianth* of 3–5 segments, mostly 3–4, *wine-red,* subgelatinous, entire, *free or generally 2–3 joined at the base,* occasionally joined for

some distance so as to appear as a single 2–3–fid segment, not forming a gamophyllous cup: *ovary* sessile or with a stalk up to 9.5 mm. long, glabrous: *style* 1 mm. long with a serrulate stigma.

Female flowers 6–11.5 mm. long, *sessile: perianth* of 3–4 segments, 1.5–2.3 mm. long, as in the gall-flowers but free, simply attached: *ovary* with a short or long stalk, 1–7 mm. long,: *style* 2.5–3.8 mm. long, generally with 2 arms, one long up to 1.2 mm. long, the other shorter, mostly much shorter and in many cases reduced to a tooth or even absent especially from the shorter flowers, in some cases the arms subequal, in a few cases with a short third arm.

Neuter flowers 4.2–9 mm. long, stalked, abundant, scattered among the female flowers, *very variable in height: perianth* 2 mm. long, as in the male flowers.

Seeds 2 mm. long, 1.2–1.4 mm. wide, pale brownish, smooth, ovoid slightly flattened, without a flange (but ? if normal: all the seeds empty though apparently normally developed).

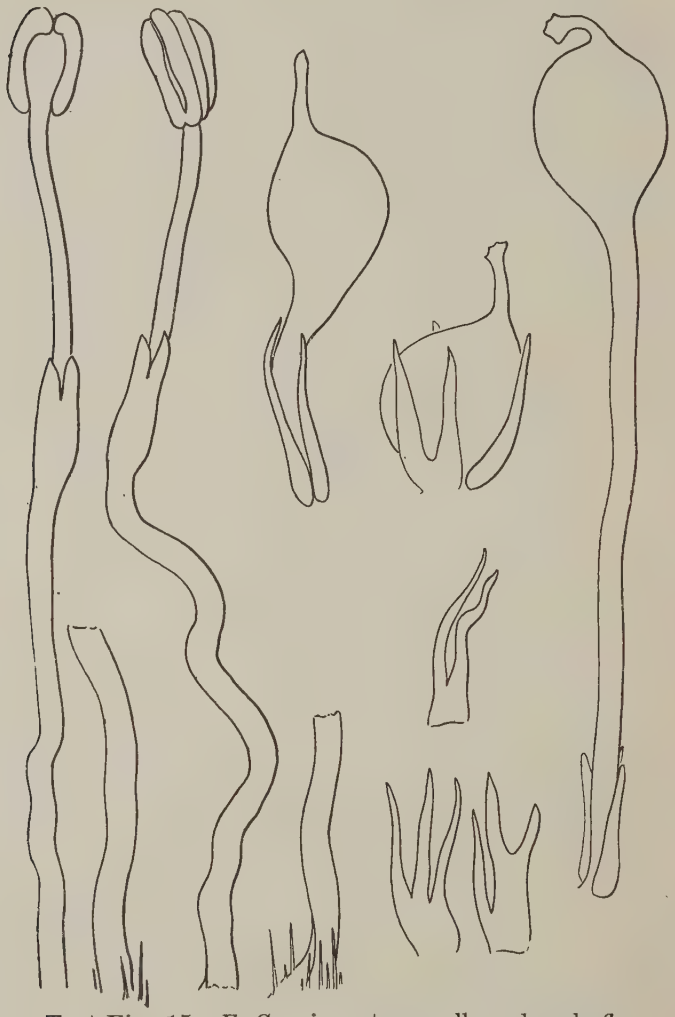


Text-Fig. 14 *F. Carri:* section through a seed-receptacle, × 2.

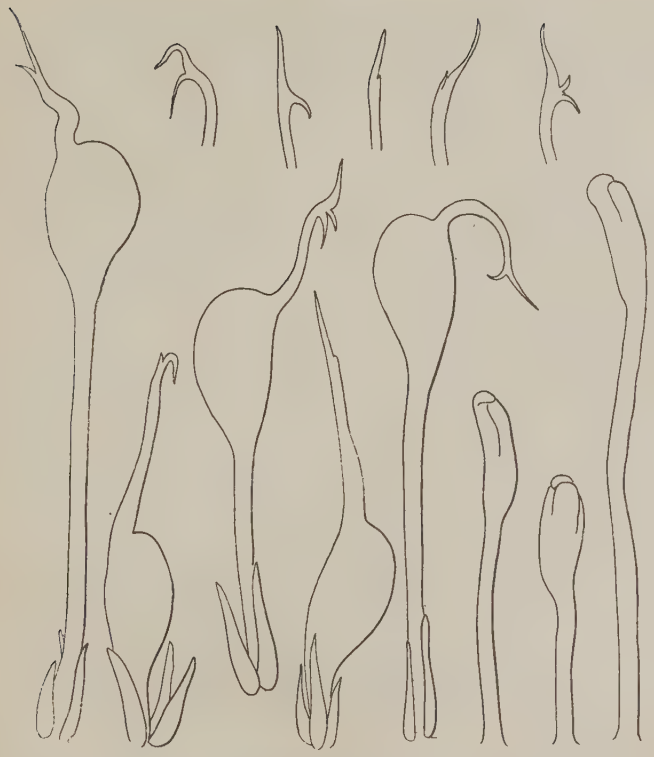
The large stiff leaves with prominent veins and the white-hairy figs render this one of the most striking species of Syncœcia that has been discovered. It is easily distinguished by the large acuminate leaves drying fawn-brown, the coarse venation, the wholly villous receptacle with sunken orifice, the very long male and gall-flowers, the neuter flowers of variable length (some much shorter than the female, others nearly as long) and the variability of the female stigma. If the seeds are without flanges, as I have described, they are also distinctive but I am not certain that they may not have been abnormal because all were empty. Strangely, too, all the gall-flowers were empty, though the stamens were clearly full-grown and both seed- and gall-figs were mature with softened wall. It seems that the

receptacles develop fully even though unvisited by the wasps.

The leaves of *F. callicarpa multinervia* approach those of *F. Carri* but are neither so large nor so coarsely veined.



Text-Fig. 15 *F. Carri:* mature gall- and male flowers from the type-collection, × 10.



Text-Fig. 16 *F. Carri:* mature female and neuter flowers, with variously shaped stigmata, × 10.

Ficus cataupi Elmer

Leaflets Philip. Botany IV, *1911,* p. 1251.

Text. Figs. 17, 35.

A lofty climber (evidently with the habit of *F. punctata*) : branches ashy grey, mottled, crookedly branching and form a more or less interlaced mass along the upperside of large limbs of the support: twigs rather slender.

Stipules, young twigs, petioles and leaves finely adpressedly pubescent, becoming glabrous, the mature leaves often slightly hairy on the underside of the veins and the tesselate pits bordered with a sparse fringe of hairs.

Leaves alternate: *blade* 3.7–8 × 1.5–3.6 cm, *rather narrowly elliptic to elliptic lanceolate,* equilateral or slightly

asymmetric and then generally slightly curved basiscopically, broadest at the middle, *gradually tapered to the subacute,* occasionally subacuminate, not retuse, *apex recurved in the living state, rigidly chartaceous,* drying coriaceous and brittle, *slightly scabrid on the upperside,* pale or yellowish green, *tesselately marked beneath with small deep, sparsely hairy pits the mouths fringed with short sparse stiff white hairs,* drying dull greyish greenish or pale greyish brownish with the midrib and main veins as fine, slightly sunken lines, the venules often showing as a fine sunken reticulum, on the underside drying greyish greenish or brownish, finely brown-dotted, with the midrib and main veins prominent and raised: *edge* of blade entire, distinctly incurved: *primary lateral veins* 5–7 prs. arising at angle of 60–70° from midrib, inarching near the margin with conspicuous loops, *strongly raised on the underside of dried leaves: secondary lateral veins,* from midrib, in some cases nearly as strong as the primaries: *secondary and tertiary veins* faint, reticulate, not raised beneath, enclosing the pits: *base equal and cuneate* (though the extreme base minutely cordate) *or slightly asymmetric with a rounded subcordate, basiscopic side* not auricled and not conspicuous, with 3 basal veins: *petioles* 3–9 mm. × 1 mm., becoming brown scurfy–flaky: *stipules* 4–8 mm. long, lanceolate.

Receptacles (copied from Elmer), *singly in the leaf axils,* puberulous when young, becoming glabrous: *peduncles* very short, thick; *basal bracts* short, rigid, (?caducous): *body* up to 5 × 3 cm. ellipsoid, smooth, blotched with brown, apparently purplish when ripe: "umbilicus nipple-shaped, the opening small and circular" (Elmer): internal bristles minute, sparse.

Male flowers 7–9 mm. high overall: *perianth* 1.5–1.8 mm. long, gamophyllous to the middle, with 3, rarely 2, subacute segments, wine red, subgelatinous: *stamen* one, 3.5–4 mm. overall: anther (dehisced) 1.5 mm. long.

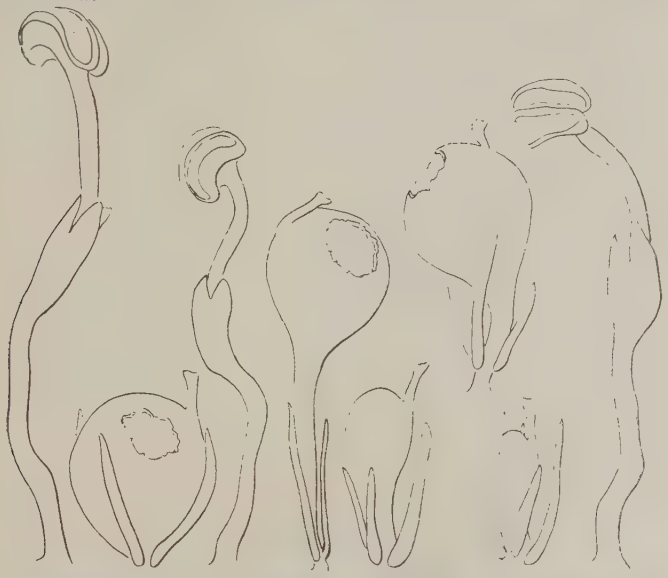
Gall flowers 3–6 mm. long overall, sessile or with a very short stalk: *perianth* of 3–4 linear entire, wine-red, subgelatinous firm pieces simply attached or subpeltate, 1.5–2.5 mm. long: *ovary* sessile or with a stalk up to 3 mm. long: ovary ca. 2 mm. wide: style .5–.9 mm. long: stigma denticulate.

Collections:—

Elmer 11822: Todayo (Mt. Apo), Davao, Mindanao, P.I. Sept. 1909: 4,500 ft.: in dense humid rigid forest, (*Type Collection*).

Elmer 14211: Cabadbaran (Mt. Urdaneta), Agusan, Mindanao Oct. 1912. (Duplicates in Herb. Bot. Bog. also examined, at the same time).

Female and neuter flowers of this species are not known and it seems that there is much to be learnt still about the receptacles, whether for instance they are always in the leaf-axils.



Text-Fig. 17 *F. cataupi:* mature gall- and male flowers, with two immature gall-flowers, from the type-collection: × 10.

Text-Fig. 18 *F. dens-echini:* section through the orifice of a seed-receptacle of the type-collection, × 2: the orifice × 3.

I do not agree with Elmer's description of the flowers: the male flowers are not subtended by bracts; the gall-flowers have the typical Syncœcia-perianth; and there is no tube encircling the stalk of the gall-flower. Nor can I agree with that author that the species is allied to *F. apiocarpa,* except remotely. It has slender twigs, the habit of *F. callicarpa,* small leaves with stomatal pits, short petioles and a different perianth so that it is clearly related to *F. callicarpa* and I expect that it has bathyphylls and marbled receptacles. *F. cataupi* is, indeed, so close to *F. callicarpa crassinervia* that the only distinguishing features that I can find in the former are the tapered acute, not retuse, apex of the leaf, the slightly more numerous side-veins, the slightly scabrid upperside of the blade, the hairiness of the stomatal pits and, perhaps, the axillary position of the receptacles, and the attachment of the sepals. None of these are points of great moment. A long series of specimens is needed before the position of such a species can be estimated.

F. barba-jovis has similar but much more asymmetric, acuminate leaves and different receptacles. Compare also *F. tulipifera* and *F. trachycoma.*

F. dens-echini nov. sp.

Text-Figs. 18, 19, 36.

F. apiocarpae similis: *lamina* 12–18 × 7.3–10.5 cm., *ovata,* medio vel basim versus latissima, equalis, subcoriacea, *apice acuminata* (5–13 mm. longa), *basi late cordata* haud profunde, *costis lateralibus utrinsecus* 4–8 subtus prominentibus, costis basalibus 3–5, *areolis minute piloso-foveolata: petiolus* 4–10 cm. *longus.*

Receptaculum axillare, ellipsoideum, 6 cm. latum, *valde umbonatum, glabrum, bractis apicalibus 5 crassis nitidis umbonatis praeditum:* setis internis deficientibus: *flores feminei* usque 16 mm. alti, *longe pedicellati, ovario sessili, perianthii segmentis* 4–5, raro 6–7, vix incrassatis, purpureis: *flores neutri* perianthii segmentis 4 plus minus liberis.

Distr. B. N. Borneo, Mt. Kinabalu.

Typus:—S.F. No. 26807 (C. E. Carr, 29.3.33).

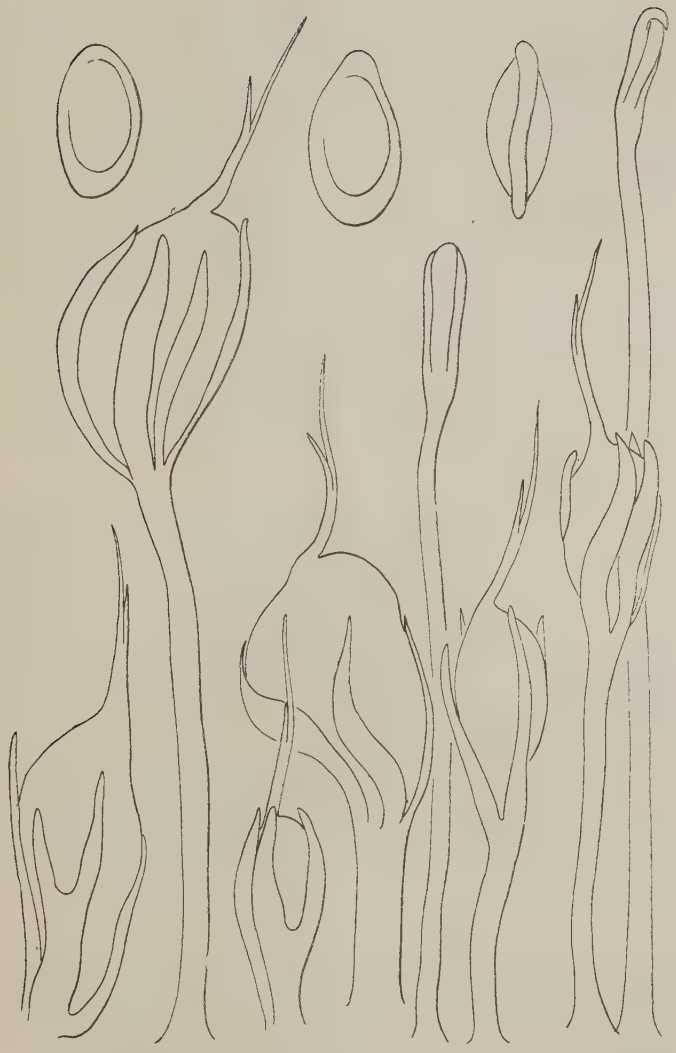
Collections:—

Carr 26807, Kinataki R., ca. 1200 m., 29.3.33: seed-figs.

Clemens 27199, Dallas, ca. 1000 m., 30.11.31 (leaves only).

Clemens 29352, Tenompok, ca, 1600 m., 20.4.32: seed-figs.

A large root-climber: stem reaching at least 1 cm. thick: twigs hollow.



Text-Fig. 19 *F. dens-echini:* mature female and neuter flowers with seeds from the type-collection: × 10.

The young parts minutely and sparsely puberulous: mature parts glabrous except the stomatal pits.

Leaf-blade 12–18 × 7.3–10.5 cm., *ovate,* broadest at or below the middle, *symmetrical, shortly and rather abruptly acuminate,* with a subacute tip 5–13 mm. long, *the base shallowly and broadly cordate, symmetrical,* edge entire and somewhat incurved, 'fleshy' (Carr's field-note), drying pale fawn or greyish on the upperside deeper fawn brown beneath with the main veins showing as fine slightly raised lines on the upper surface: *primary lateral veins* 4–8 pairs, arising at an angle of 70–90° from the midrib, distinctly arching at the margin, prominent beneath in the dried leaf, faint above: *secondary veins* reticulate: *tertiary veins* enclosing square or oblong areolae tesselate *with minute hairy stomatal pits,* finely tuberculate along the veinlets in the dried leaf: *basal veins* 3–5, the main lateral ones making an angle of 60–70° with the median: *petiole* 4–10 cm. *long,* 2.5–4 mm. wide, becoming brown scurfy: *stipules* 15–45 mm. long, broadly lanceolate.

Bathyphylls?

Receptacles axillary or on rudimentary leafless twigs on the old stems, singly or in pairs, *ripening dark brown with paler speckling: peduncles* 2–5 mm. long, 7–11 mm. wide, *very short and thick: basal bracts* 3, 3–4 mm. long, broad, obtuse, membranous, glabrous: neck 2.5–3.5 × .6–.8 cm. pronounced: *body* 7 × 6 cm., ellipsoid, not pyriform, *with a broad apical umbo* 2.5 cm. wide and .6 cm. high: *orifice* 6–7 mm. wide, scarcely prominent, not sunken, *entirely closed by 5 large, thick, shining, umbonate, apical bracts: internal bristles* absent.

Female flowers 6.5–16 mm. long overall, *tall,* sessile or stalked: *pedicel* slender, glabrous, up to 9 mm. long: *perianth* of 4–5, rarely 6 or 7, lanceolate, subacute or acute, thin, flat or slightly fleshy, entire, wine-red segments 2–4 mm. long, free or occasionally 2–3 joined near the base or to the middle, simply attached: *ovary sessile or subsessile: style* 3–3.5 mm. long.

Seed 2.3–2.8 mm. long, × 1.3–1.6 mm. wide, 1 mm. thick.

Neuter flowers 8–16 mm. high: pedicel slender: *perianth* 2.5 mm. long with 4, rarely 3, entire, wine-red, slightly hooded segments free or narrowly joined at the base: a few with an abortive rudimentary pistil: mostly empty.

Gall- and male flowers unknown.

Unless one examines this species carefully it will be mistaken for *F. apiocarpa, F. Bordenii,* or *F. Scratchleyana.* From all it differs in possessing minute stomatal pits,

distinctly and broadly cordate leaves with long stalks, a sessile ovary in the very large female flowers and five big umbonate bracts round the orifice of the fig. From this feature, which suggests "Aristotle's Lantern" in oral view, I give the specific epithet. The leaves resemble in an extraordinary degree those of some climbing species of Eusyce collected by Mr. Carr in Papua. The brown colour of the ripe figs recalls *F. Bordenii*. At maturity the pedicels and ovary-walls become glued together so that the flowers are difficult or impossible to separate, but the perianth-segments remain free and entire; they are never reticulate-dentate as in *F. apiocarpa*.

The receptacle which Mr. Carr preserved in spirit has an uneven and strongly rugose surface but whether naturally so when fresh or because it was partly dried or has shrunk in spirit, I do not know.

The sheet of Clemens 27199 in the Singapore Herbarium has the leaves of *F. dens-echini* and a part of a receptacle which probably belongs to *F. callicarpa parvifolia*.

F. grandiflora nov. sp.

Text-Figs. 20, 21.

F. callicarpae affinis: *lamina* 10–16.5 × 4.2–7 cm., *elliptica*, saepe anguste, *utrinque attenuata, apice acuta*, subcoriacea, *aequalis vel vix falcata, costis lateralibus utrinsecus* 6–9, vix prominentibus, basalibus 3, *areolis piloso-foveolatis:* petiolus 12–20 mm. longus.

Receptaculum ut in *F. callicarpa*, 6–7 cm. latum: *flores magni, pedicellis crassis:* flores masculi 20–25 mm. longi, pedicello 1 mm. crasso: *flores cecidiophori* 6–17 mm. longi, pedicello 1–2 mm. crasso, *perianthii segmentis* 4–6, *plerumque* 5, simpliciter adnexis, *crassis*, gelatinosis, purpureis *liberis vel plerumque 2–3 connexis vel omnino breviter connexis ovario sessili amplectantibus.*

Distr. Brit. N. Borneo, Mt. Kinabalu.

Typus. Clemens 30290, Dallas, ca. 1000 m., 2.12.31 (specimen in Herb. Hort. Sing.).

Paratypus. Clemens 27139, ibid., 1.11.31 (leaves only: receptacles of another species).

Apparently with the habit of *F. callicarpa*.

Wholly glabrous except for the hairy stomatal pits on the underside of the leaf and the internal bristles of the receptacle.

Bathyphylls?

Leaf-blade 10–16.5 × 4.2–7 cm., *elliptic, often narrowly, tapered gradually to each end*, equilateral or slightly curved and asymmetric, the apex subacuminate, the base narrowly cuneate, edges entire but incurled when dried, thinly coriacous, *densely and rather coarsely foveolate on the*

underside with hairy stomatal pits, drying greenish brownish to fawn-brown on both sides, not scabrid; *primary lateral veins* 6–9 pairs, making an angle of ca. 65° with the midrib, inarching near the margin, as fine raised lines on the upperside of the dried leaf, more distinctly raised beneath but not prominent: *secondary and tertiary veins* distinct but not raised: *basal veins* 3: *petiole* 12–20 × 1.5–2 mm., becoming brown flaky: *stipules* 10–17 mm. long.

Receptacles evidently as in *F. callicarpa*, large glabrous, red and marbled, arising from the creeping main stems, 6–7 mm. wide.

Male flowers 20–25 mm. long overall, very numerous, *with very stout flexuous white stalks* 1 mm. thick: *perianth* 3–4 mm. long, wine-red, *with* 3–4, rarely 2, *lanceolate lobes united for* 1/3–½ *their length: stamen* 3.5–4.5 mm. long overall, the anther 2.5 mm. long, not exsert (but ? full-grown).

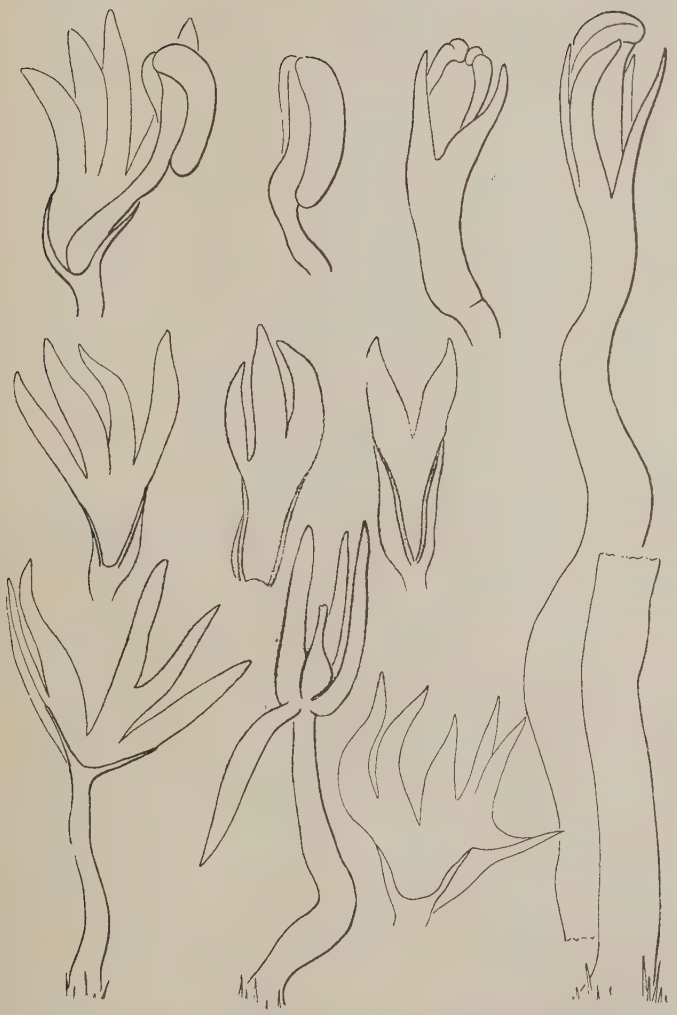
Gall-flowers 6–17 mm. long overall, crowded among the male flowers, many undeveloped, *with very stout, flexuous, white stalks* 2–3 mm. long, 1–2 mm. thick: *perianth composed of* 4–6, mostly 5, *lanceolate, thick, stout, gelatinous, wine-red segments* 2–4 mm. long, *free or commonly* 2–3 *united for* ¼–2/3 *their length, or all united for* ¼ *their length into a shallow gamophyllous cup: ovary sessile*, 2–2.5 mm. wide, *clasped by the coarse sepals*, the style tiny, .6–.8 mm. long.

This species is distinguished from all others in the subgenus by its very large, stoutly stalked flowers, its coarse perianth-segments that are rather more numerous than usual and by the sessile ovary of the gall-flower. The other species of Synœcia have filamentous pedicels .2–.6 mm. wide (1–2 mm. wide in *F. grandiflora*) and the ovary in their gall-flowers is commonly stalked so as to raise it above the level of attachment of the perianth. The flowers of *F. grandiflora* must be well-nigh the biggest in the genus.

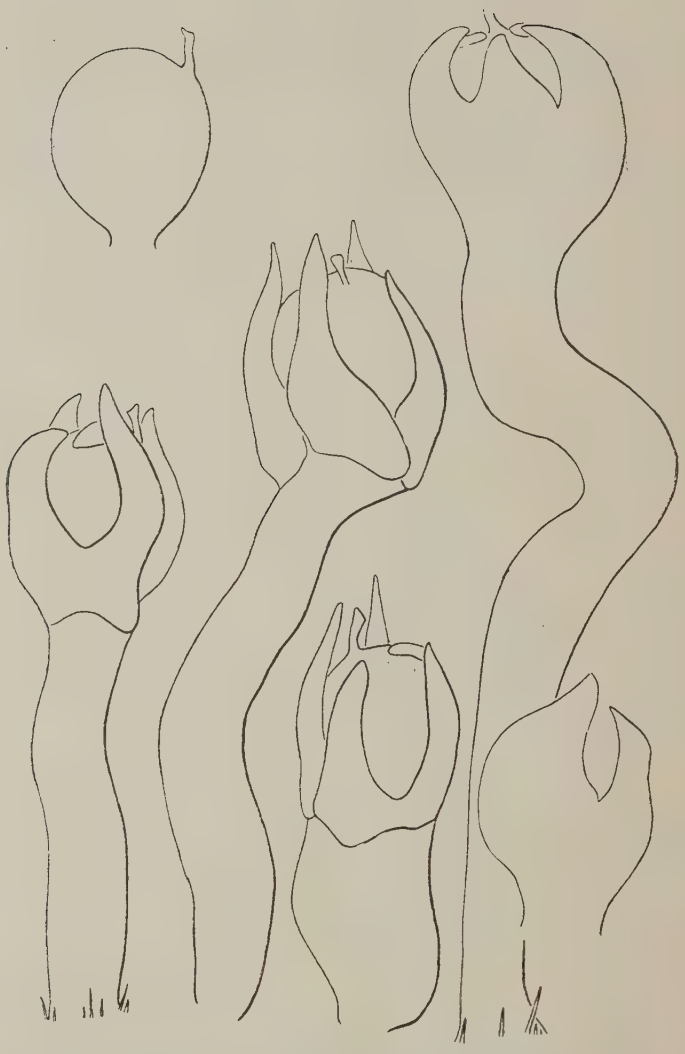
F. dens-echini approaches *F. grandiflora* in the sessile ovary of its female flowers and I think that the two may be allied. *F. tulipifera* also has rather coarse sepals and clumsy flowers but it has much smaller figs, flowers and leaves and its gall-flowers are sessile with a stalked ovary.

In leaf *F. grandiflora* resembles *F. callicarpa multinervia* but the veins are not impressed above nor are they so strong beneath.

The collection Clemens 27139 is mixed, at least the sheet in the Singapore herbarium, for it bears the leafy twig of *F. grandiflora* and both a gall- and a seed-fig (!) of what is probably *F. callicarpa parvifolia*. Hence my limitation of the type-collection to the specimen which I have seen at Singapore.



Text-Fig. 20 *F. grandiflora:* mature male flowers and (bottom left) 2 undeveloped gall-flowers with a perianth cut-open, from the type-collection: × 10.



Text-Fig. 21 *F. grandiflora:* mature gall-flowers from the type-collection: × 10.

Ficus punctata Thunb.

Text Figs. 8, 22–25, 33.

Stipules, twigs and petioles finely adpressedly hairy, the twigs and petioles slowly glabrescent: occasionally with the hairs rather spreading, receptacles closely velvety-hairy.

Lamina 1.5–4.7 × .6–2.5 cm., *rather small, linear-oblong to lanceolate-obovate or elliptic-obovate, generally rather narrow and gradually narrowed to the base, more or less distinctly inequilateral and subfalcate,* rarely equilateral, coriaceous, glabrous, shining green above, pale green and *tesselate beneath with minute white hairy stomatal pits* in the areolae, drying pale dirty greyish green or greyish yellowish on both sides, or slightly brownish on the underside: *edges* entire, slightly incurved: *apex blunt,* retuse, rarely tapered and subacute-retuse: *primary lateral veins* 3–5 pairs, distinctly inarching near the margin, in dried leaves slightly raised on the underside, hardly visible on the upperside: *secondary lat. veins* faint, scarcely raised: *tertiary lat. veins* not raised, fine, enclosing the stomatal pits: *base attenuate, generally more or less distinctly asymmetric, the broader side subcordate,* rarely symmetric, not auricled, with 3–5 basal veins, the lateral ones faint: *petiole* 1.5–9 mm. long, 1 mm. wide, slender, becoming brown scurfy-flaky: *stipules* 2–7 mm. long, lanceolate, fairly persistent.

Bathyphylls: lamina 4–8 × 1.5–6 mm., like the mature leaves but smaller, often elliptic-lanceolate, always strongly asymmetric and falcate, the acroscopic side often very narrow or reduced to a wing: the youngest bathyphylls on seedling plants without stomatal pits.

Receptacles cauliflorous on woody, stipulate tubercles up to 3.5 cm. long on the main stem or the bases of the larger side-branches, hanging: *peduncle* up to 2 cm. long, or absent, stout, finely white puberulous: *basal bracts* 3, 3–4 mm. long, broadly triangular, acute, adressedly puberulous like the stipules: *body* 5–11 × 4–8 cm., *globoso-pyriform with a broad low umbo* ca. 17 mm. wide × 3 mm. high, *finely velvety hispid* with short white bristles, *faintly papillate over the whole surface with scattered large blunt papillae* ca. 1 mm. wide and placed 2–10 mm. apart, the intervals between them beset with the hairs and tiny crowded often contiguous papillae or irregular processes giving a rugulose appearance (like the surface of a powdery Lycoperdon), *peach-pink, not marbled: neck* .4–2 cm. long: *orifice* 4 mm. wide, in a shallow depression in the umbo, surrounded by the small inconspicuous apical bracts and closed by the broader internal bracts: *internal bristles* abundant, seldom scarce or even absent.

Male flowers 9–15 mm. long: pedicel white, glabrous: *perianth* 1–2 mm. long,wine-red, tubular for half its length, with 3, rarely 2, thick, subgelatinous lobes: *stamen* 3–5.5 mm. long, anther 1.5–1.8 mm. long and fully exsert.

Gall-flowers 3.5–8.5 mm. long, sessile or with a stalk up to 2 mm. long: *perianth* of 0–3 segments, generally 1–2, free, linear, entire subgelatinous, wine-red, 2–5 mm. long, with simply attached base: *ovary* 1.2–2.2 mm. wide, sessile or with a stalk up to 4 mm. long: *style* .7–1.5 mm. long: stigma distinctly denticulate.

Text-Fig. 22 *F. punctata:* section through the orifice of a full-grown gall-receptacle, × 2: orifice × 3, (Henderson 29669, Malaya).

Female flowers 3.5–6 mm. long, sessile or substipitate: *perianth* as in the gall-flowers but the segments shorter, 1–3 mm. long: *ovary* .8–.9 mm. wide, sessile or with a stalk up to 2.5 mm. long: *style* slender glabrous, 1.8–3.4 mm. long: *stigma* with slender, unequal arms, the longer .7–1.2 mm. long, occasionally subequal.

Neuter flowers 4–5.5 mm. long, stalked: *perianth* 1.5–1.8 mm. long, gamophyllous to the middle with 3 segments, one more or less hooded over the others, wine-red, subgelatinous, thick, in some cases enclosing a sterile rod.

Seeds 1.6–2 mm. long, pale straw-colour, smooth, hard, flattened and keeled.

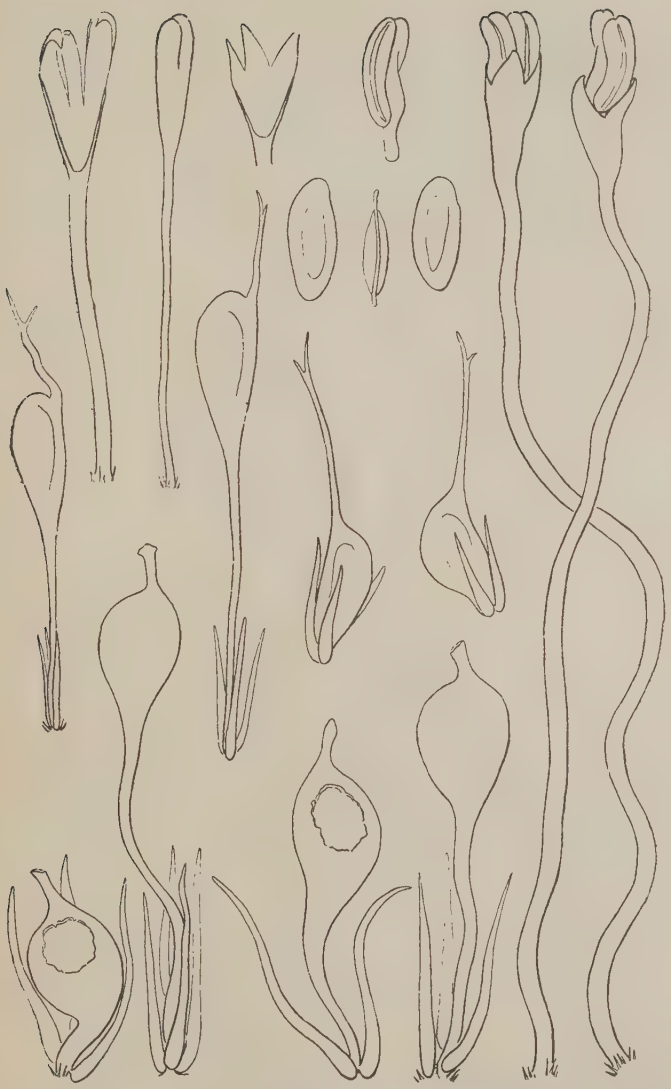
Habitat:—in high forest in plains and mountains to an altitude of 1500 m., also in villages and orchards.

Distribution.—Java, Sumatra, Malaya, S.E. Borneo.

Collections:—

BORNEO: Jaheri 829, S. Dengey, (Exp. Nieuwenhuis, 1896–7): H. Winkler 2357, 9.6.08.

JAVA: Backer 1682, 6173, 9426, 10117, 10561, 10916, 14058, 14203, 16287, 23851, 25468: Bakhuizen v.d. Brink 1297, 1615, 1776, 2297, 4330: Bruggeman 431: Dakkus 39:

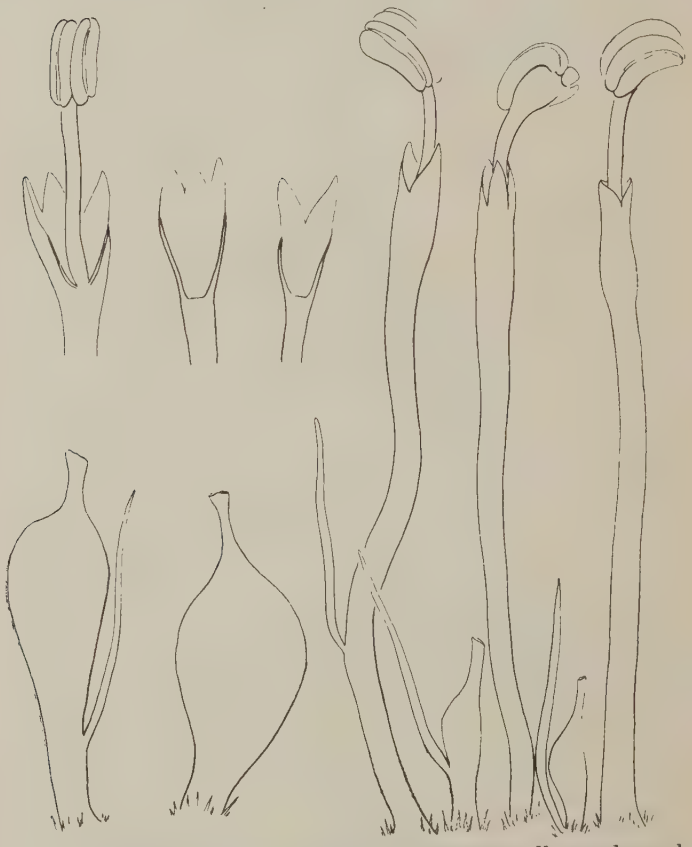


Text-Fig. 23 *F. punctata:* mature male, neuter, gall- and female flowers and 3 seeds: × 10.

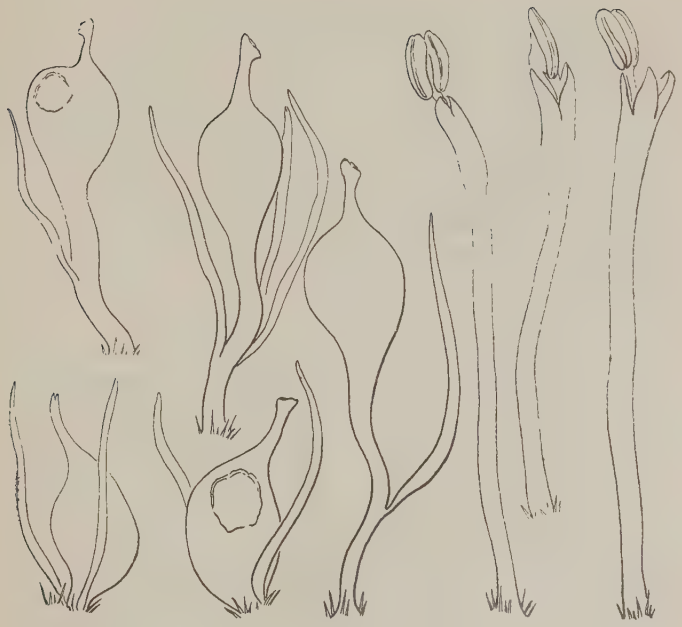
Docters v. Leeuwen s.n. 28.9.10: Forbes 257, 283, 302: Hallier s.n. 27.12.94: Herb. Hort. Bot. Bog. 6916: Hundeslagen s.n. 1921: Junghuhn 3: King s.n. 1872: Koorders 15473, 20431, 23596, 23780, 24419, 26044, 26342, 28692, 28696, 31559, 32876, 39237, 41480, 41546, 42990, 43696, 44550: Kurz 678, s.n. Hort. Bog.: de Monchy 118: Scheffer 7032: van Steenis 141, 2409, 2426, 4010: Winckel 430, 1145.

MALAYA: Foxworthy 2585: Goodenough 10542: Henderson 29669; Hume 7312, 8293, 8639: Kunstler 4278, 4828: Ridley s.n. Batu Caves: Symington 24530: (Perak, Selangor, Kelantan).

SUMATRA: Koorders s.n. Sumatra (Herb. Calc.): Lorzing 6396.



Text-Fig. 24 *F. punctata:* mature gall- and male flowers, and 2 immature gall-flowers of the collection Corner s.n. Bentong, Pahang, 30–10–32; × 10.



Text-Fig. 25 *F. punctata:* mature gall- and male flowers of the collection Foxworthy 2585 (Malaya) : × 10.

It may be that *F. callicarpa* and *F. punctata* should be united but I prefer to distinguish them until they are better known. *F. callicarpa* has glabrous, orange-red receptacles marbled with pale, innate spots, and rather broad leaves. *F. punctata* has wholly villous, peach-pink to reddish pink receptacles, not marbled but papillate with tiny spaced lumps, and small narrow leaves. In venation, flower and seed-structure I can find no constant difference because both are very variable. The perianth of the gall-flower, however, is often more or less deficient in *F. punctata* and the segments in both gall- and female flowers seem always to be simply attached.

Against such specific distinction may be set the following facts:—

1. *F. callicarpa angustifolia* has the leaves of *F. punctata* and the receptacles of *F. callicarpa* but they are not marbled but papillate as in *F. punctata.* It

might as well be made a variety of *F. punctata* with glabrous orange-red receptacles.

2. In *F. callicarpa parvifolia* the young receptacles may be more or less villous and become glabrous only when reaching maturity.

3. Near Bentong in Pahang, I collected on the 30th October, 1932, a plant with the receptacles of *F. punctata* and the leaves of *F. callicarpa typica*. That the receptacles and leaves came off the same stem I can testify because I climbed the tree to collect the specimens. The receptacles contained gall-flowers which had 0–1 perianth segments as in certain specimens of *F. punctata* from Malaya and Java (Text Fig. 24).

F. punctata is probably an advanced state of *F. callicarpa* with persistently villous receptacles and reduced leaves, that has been evolved on the Sunda-shelf. It seems the commonest Syncœcia in Java where it is remarkably constant. It is through the Javanese collections that I have been able to identify the bathyphylls. Lorzing 6396 and Winckel 430 have both receptacles and bathyphylls attached to the same woody stems. The passage from the very juvenile bathyphylls without stomatal pits to those with stomatal pits is shown by Koorders 23780 and 42990, Forbes 257, and Bakhuizen v.d. Brink 1615. Under Koorders 23780 is a sheet of a sterile twig with very hairy, symmetric, cordate leaves which possibly represents a Eusyce such as *F. repens* or *F. villosa*. Dakkus 39 has unusually broad leaves.

As in *F. callicarpa*, the male flowers vary much in length but in each collection, and presumably therefore in each plant, they are constant within normal limits, e.g.:—

Collection	*Length of Male Flower (overall) in mm.*
v. Steenis 4010	9
Winckel 430	10
Backer 14203	10–11
Bruggeman 431	11–13
Lorzing 6396	12–14
Koorders 28696	12–15

The number of perianth-segments in the gall-flowers also varies in different collections. Henderson 29669 (Malaya), Backer 14203 and Koorders 28696 have no perianth. Koorders 41480 has no perianth to some of the female flowers and no internal bristles.

The record of *F. punctata* from Indo-China must be *F. callicarpa parvifolia*, if it is a Syncœcia at all.

F. Scratchleyana King
Ann. R.B.G. Calc. 2, *1888*, suppl., p. 5.

Text-Figs. 26, 36.

A climber closely resembling *F. apiocarpa.*

Young twigs and leaves finely hairy at first, soon glabrous: twigs thick.

Leaf-blade 7–20 × 4.5–9.6 cm., *broadly ovate to narrowly ovate or ovate-lanceolate*, glabrous, coriaceous, symmetrical, *the apex acuminate* with a tip .5–2 cm. long, *the base widely cuneate and rounded or almost truncate and broad,* not cordate, with entire edge, drying greyish brownish on the underside and tesselate with brownish areolæ, *without stomatal pits: primary lateral veins* 6–9 pairs, making an angle of 60–75° with the midrib, flush with the upper surface of dried leaves and slightly raised on the under surface, inarching near the margin, the arches only 1–2 mm. from the edge, without a marginal vein: *secondary veins* rather distant, more or less transverse, not raised: *tertiary reticulations* fine and distinct in dried leaves, not raised, minutely tuberculate: *basal veins* 3, *the lateral ones* making an angle of 45° with the midrib and *reaching* ¼–1/3 *the length of the blade: petioles* 2–6 × .2–.3 cm., becoming brown scurfy: *stipules* 1–2 cm. long. lanceolate, soon glabrous.

Receptacles in the leaf-axils, apparently shaped as in *F. apiocarpa* but not so large, puberulous becoming glabrous: *peduncle* 1–12 mm. long, rather slender in dried specimens: *basal bracts* 1.5–2.5 mm. long. crescentic, blunt, sparsely hairy on the back: *neck* long and pronounced in dried specimens: orifice ?: *internal bristles* abundant, .5–1 mm. long.

Male flowers 6–8 mm. overall (evidently mature, having dehisced anthers): pedicel 3–5 mm. long: *perianth* 2.5–3.5 mm. long, *composed of 3 rather broad, separate, wine-red segments* with down-curved, hooded tips in the bud, occasionally 2 segments joined to the middle: *stamen* 3–3.5 mm. long: anther scarcely exsert.

Gall-flowers 3–6 mm. high overall, sessile or very shortly stalked.: *perianth* of 3–4 segments, 3–7 mm. long, *free,* rarely 2 joined, linear, entire, subgelatinous, simply attached, wine-red: *ovary* sessile or with a stalk up to 2 mm. long: *style* .5–.8 mm. long, with denticulate stigma.

[*Fertile female* flowers pedicellate; the perianth of 4 linear pieces; ovary ovoid-elliptic; the style lateral: stigma large, bicrural when young, truncate when adult from the absorption of the arms.

Neuter flowers mixed with the females all over the receptacle, pedicellate; the perianth of 4 lanceolate pieces. (ex King).]

Distr. Philippines, New Guinea.

Collections:—

PHILIPPINES:—

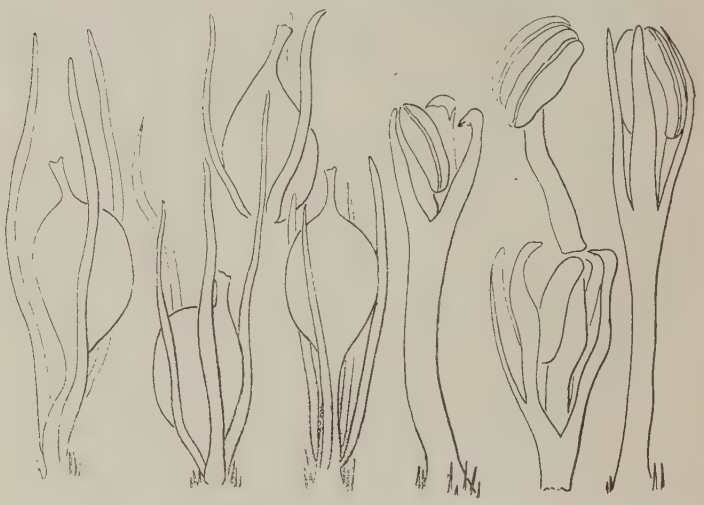
Elmer 7445 (Lucban, Luzon): 10232 (Island of Negros): 16116 (Sorsogon, Luzon): 22156 (Mt. Pinatubo, Luzon).

Ramos 22200 (Mt. Iriga, Camarines): 23331 (Sorsogon, Luzon).

Mabesa 28055 (Batangas, Luzon).

Villamil 21382 (Mt. Maquiling, Luzon).

NEW GUINEA: H. O. Forbes 900 (Type, not seen).



Text-Fig. 26 *F. Scratchleyana:* mature gall- and male flowers (Philippine specimens): × 10.

The Philippine collections on which I have based this description (with the exception of the female and neuter flowers which have been taken from King) have been referred to *F. apiocarpa.* There is yet no evidence, however, that *F. apiocarpa* occurs in the Philippines, Elmer had, indeed, proposed the manuscript name *F. peninsula* for these specimens. My reasons for identifying them with *F. Scratchleyana* are as follows.

The type of *F. Scratchleyana* (Forbes, New Guinea) is in the British Museum. (It is doubtful if any duplicate exists, for there is none at Kew nor at Calcutta). Mr. C. E. C. Fischer kindly examined the type for me and reported that there were no hairy stomatal pits on the underside of the leaves. Reconsidering King's description in the light of this fact, I find that it corresponds very closely to these Philippine collections and to *F. Bordenii.* That it is not *F. Bordenii* I am certain from King's

description of the petiole as 1–1.5″ long (½–¾″ in *F. Bordenii*) and the leaf-blade as tapered to the base with 3 basal veins in *F. Scratchleyana*. Moreover, King's description and figure apply excellently to the Philippine "F. apiocarpa". Elmer 16116 might have been the object of King's figure except that the leaf-tip in the figure is rather short. This, indeed, is the sole discrepancy and I do not see how one can maintain two species on such a triviality.

I have purposely based my description of *F. Scratchleyana* entirely on the Philippine specimens so that, should they turn out to be another species, I shall have created no confusion except in identity. Seed-figs have not yet been collected in the Philippines.

There is no doubt that *F. Scratchleyana* is closely related to *F. apiocarpa* but it differs markedly in the venation and the perianth. It seems to be the only species of Syncœcia that has reached New Guinea.

F. Simiæ Winkler

Engl. Bot. Jahrb. 49, *1913*, p. 362.

A big climber: stem 6–8 cm. thick.

Bathyphylls?

Leaf-blade 26 × 13 cm. *large, oval, rounded obtuse at base and apex,* (symmetrical), coriaceous, glabrous: *primary lateral veins 9–10 pairs,* prominent on the underside, scarcely visible above, the basal nerves 3 the areolæ *white-spotted* (? with stomatal pits).

Receptacles cauliflorous on woody branches 6–10 cm. long: *peduncle* 2 cm. long (? including the neck): *body* ca. 10 × 8 cm. with the wall 12–15 mm. thick, *yellow or red* (? marbled with paler spots), *glabrous: orifice* slightly sunken: *internal bristles present.*

Male flowers with pedicels 9–10 mm. long and dilated below the tubular, 3–partite perianth (1 mm. long): stamen with the filament 3–4 mm. long, the anther exsert.

Gall flowers sessile or stalked (? ovary stalk), always shorter than the male; perianth of 2–3–4 free, linear or subulate segments, sometimes 1–2 lobed, "fuscous with hyaline margin".

Distr. S.E. Borneo, Hayup.

Type. Winkler 2515.

This description is taken from Winkler's. I have little doubt that *F. Simiae* is another Bornean speciality of Syncœcia but it is unwise to regard it as a scientific fact until it has been discovered again. It was described from a stem with receptacles and one fallen leaf, the connection of which with the rest of the plant was not ascertained but merely surmised from its white tesselate lower surface and from the absence of other species of Ficus in the vicinity.

It seems to be a variety of *F. callicarpa* with big leaves and thus to suggest that the big-leafed ancestor of *F. callicarpa* also evolved in Borneo, whence the species has spread.

Ficus singalana King.

Ann. Roy. Bot. Gard. Calc. 2, *1888,* p. 70.

I think this is my *F. callicarpa multinervia.* I have seen no specimen of *F. singalana,* but from King's description and figure I do not see how to distinguish it specifically from *F. callicarpa.* King was not aware of the extraordinary variability of *F. callicarpa* and the manner in which its leaves grade into those of *F. punctata.*

F. tawænsis Merrill

Univ. Calif. Publ. Bot. 15. *1929,* p. 48.

Text-Figs. 27, 35.

A tall, strong root-climber, the main stem up to 15 cm. wide, dull brown (dried), coarsely lenticellate.

Twigs, petioles and stipules closely pilose with rather short, subferruginous (dried) hairs, adpressed on the stipules, villous on the other parts, the twigs ultimately glabrous: *leaf-blade when young densely villous with whitish hairs,* becoming subglabrous on the upperside but scabrid from the persistent, papillate hair-bases, *on the lower side persistently hairy* especially along the veins.

Leaf-blade 2.5–7 × 1.4–3.3 cm., *elliptic or narrowly ovate-elliptic, symmetrical with the base broadly cordate and with a rather deep sinus between the lobes, the apex rounded or subacute,* not retuse or acuminate, subcoriaceous, the edge entire, dark green above, much paler beneath, drying dull grey or greyish brown on the upperside with the main veins distinct but not raised or sunken and the reticulate veins as very slightly raised, fine lines, on the underside paler greenish grey with the midrib and main veins prominent and raised: *primary lateral veins* 3–5 pairs, making an angle of ca. 50° with the midrib, inarching near the margin but without a distinct marginal vein, slightly raised beneath in dried leaves: *secondary and tertiary veins* reticulate, not or scarcely raised, fine but distinct, with pale brown spots in the reticulations, *without stomatal pits: basal veins* 5–7: *petiole* 3–7 × 1.5 mm., short: stipules 3–6 mm. long.

Receptacles cauline on short, stout, woody twigs up to 5 cm. long, hanging, subglobose, up to 12 cm. diameter, with a peduncle 2–3.5 cm. long, *closely and shortly villous,* (evidently slightly papillate but not mottled), *peach-red* on the exposed side, peach-yellow on the shaded side: *internal bristles* up to 1.5 mm. long, forming a chaffy layer round the bases of the flowers.

Male flowers: (immature) 8–9 mm. long overall: *perianth* 1–1.5 mm. long, gamophyllous to the middle with 3, rarely 2, lobes: *stamen* 2–2.5 mm. long (immature), rarely 2: *anther* 1 mm. long, exsert.

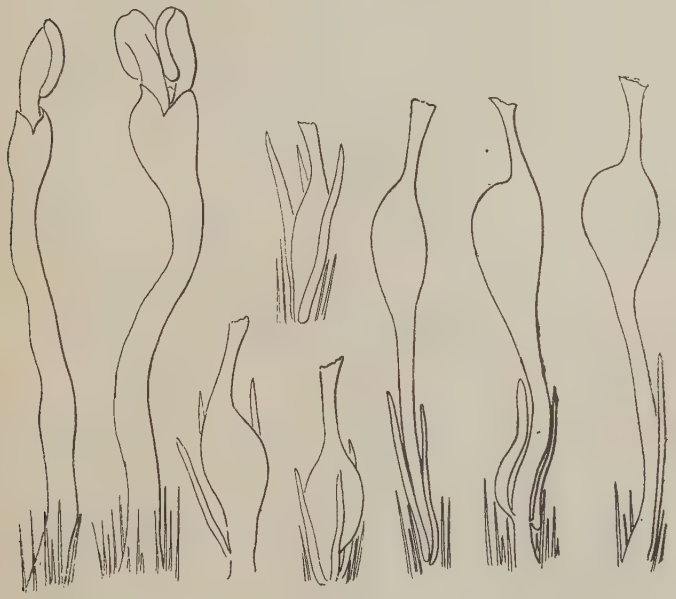
Gall-flowers: (immature) 3.5–7.5 mm. long overall, sessile or with a very short stalk up to .5 mm. long: *perianth* of 1–3, generally 3, linear entire, subgelatinous, free, wine-red segments, simply attached, 2–3 mm. long: *ovary* subsessile or with a stalk up to 4 mm. long: *style* 1.3–1.4 mm. long with denticulate stigma.

Female and neuter flowers and seeds unknown.

Distr. Brit. N. Borneo.

Collections:—

Elmer 20531, pr. Tawao (type).



Text-Fig. 27 *F. tawaensis:* gall- and male flowers (immature), from the type-collection: × 10.

This species is known only from the type-collection, of which I have seen the specimens in Manila, Buitenzorg and Singapore. It is a true Synœcia with receptacles like *F. punctata* but the leaves are very unlike Synœcia-leaves in being regularly and deeply cordate, persistently villous on

the underside and without stomatal pits: they suggest, in fact, a Eusyce as *F. pumila.* The woody fruiting tubercles which Merrill remarked as distinctive and like those of Covellia are no different from those of old, massive plants of *F. punctata* or *F. callicapra.* The receptacles, if really 12 cm. wide and subglobose, must be the largest figs that have yet been found in the genus. The receptacles, however, are imperfectly known, the preserved specimens being too fragmentary to discover any details. The flowers are in no way distinctive.

I believe that *F. tawaensis* has the habit of *F. punctata* and that it has bathyphylls. The type-sheet in Manila consists of acrophylls but the duplicate at Buitenzorg seems to be entirely bathyphyll-shoots except for one detached acrophyll. These bathyphyll-shoots are lax with long internodes and are rooted at the nodes like the typical bathyphyll-shoots of *F. callicarpa:* the leaves are smaller than the acrophylls of the type-sheet, more oblong and with an almost rounded-hastate base suggesting a 'Convolvulus-leaf': they are symmetric and it is possible that they are the leaves intermediate between bathyphylls and acrophylls.

Koorders 23780 (Tangkil, Paserœan, Java), determined as *F. punctata* var., is a sterile collection of bathyphylls remarkably like those of *F. tawaensis* but I hesitate to identify it without further evidence. It may be the young stage of a climbing Eusyce.

F. trachycoma Miq.

Fl. Ind. Bat. I. pt. II, *1859,* p. 304.

? = *F. aurantiaca* Griff. Notulæ pt. 4, *1854,* p. 394.

Icon. t. 555 fig. II.

Text Fig. 32.

Blade 4–10.5 × 2.5–6.5 cm., *ovate elliptic,* slightly or distinctly inequilateral, stiffly coriaceous, *narrowed gradually to the subacute or acute tip,* in some cases apiculate, *the upperside more or less harshly scabrid* with short, white stiff forward pointing hairs with swollen bases, *or scabrid only in the distal half* or weathering smooth, *underside similarly wholly scabrid and with minute hairy stomatal pits in the areolae: edge* entire or very minutely toothed, often slightly incurved: *primary lateral veins 7–10 pairs, arising at a wide angle of 65–70° from the midrib,* inarching at a distance of 2–3 mm. from the edge, hardly visible on the upperside of dried leaves, very slightly raised below, fine: secondary veins faint, irregular: *base rather broadly rounded, subcordate,* slightly but distinctly or scarcely asymmetric, with 3 nerves: *petioles* .5–1.5 × .2 cm, *short,* thick glabrous: *stipules* 8–15 mm. lanceolate, finely hairy to glabrescent.

Receptacles rather large, *axillary on the leafy twigs, scabrous,* umbonate when young, ripening orange-red (apparently with ovoid cylindric body, rather long neck and very short peduncle).

Flowers?

Distrib. Java, (Tjibodas, Mt. Salak).

Collections:—Herb. Horb. Bot. Bog. 7220, cult. Buitenzorg. v. Steenis 2698, G. Tjibodas ± 275 m.

This is a rare species, evidently allied closely with *F. callicarpa,* and one of which there are no recent collections with receptacles. Its distinguishing characters are the rather broad, pointed, scabrid leaves with rounded base and many pairs of side-veins and the scabrid axillary receptacles. Neither the flowers, nor the bathyphylls nor any details of the receptacles are known. It may well be a variety of *F. callicarpa.* From *F. cataupi,* which also has scabrid leaves, it differs in the broader blade with more numerous, fine lateral veins.

I have avoided reference to King's description of *F. aurantiaca* Griffith because I believe that it is a mixture. I have not seen Griffith's specimen but his description and figure suggest the young stage of *F. callicarpa,* which may have axillary receptacles. Griffith's habitat is "on trees, Malacca". I have collected in Malacca several times in the last few years and found only *F. callicarpa typica, F. callicarpa crassinervia* and *F. apiocarpa* as species of Syncœcia, the first being very common on coconuts and durians in all the villages, so that Griffith could hardly have missed it. On the other hand, specimens agreeing with the Javanese *F. trachycoma* have never been seen in Malaya in the last eighty years. I think that King mistakenly identified Griffith's plant with the Javanese and thus gave a mixed description with floral characters taken from Griffith's plate. The leaves drawn by Griffith are just like those of *F. callicarpa* which are transitional between bathyphylls and acrophylls and shoots bearing such leaves may develop precocious, axillary receptacles. The undersides of the leaves of *F. callicarpa,* moreover, are "tactu aspera verruculis plurimis albis", as Griffith described, because of the slightly raised margins of the stomatal pits. Burkill's record of *F. aurantiaca* (S.F. No. 6429) is *F. callicarpa.*

If *F. aurantiaca* Griffith is *F. callicarpa* Miq. it is an earlier name but it is also a later homonym of *F. aurantiaca* Noronha (4) and *F. aurantiaca* Hort. Berol. (4). (Griffith spelt the name *F. aurantiaceus*). Hence I conclude that Griffith's name disappears from taxonomy and in its place stands *F. callicarpa* Miq. and *F. trachycoma* Miq. which may be a variety of the former.

The collection, v. Steenis 2698, identified as *"F. punctata"* has smaller, more asymmetric leaves than Herb. Hort. Bot. Bog. 7220, which seems to be typical *F. trachycoma*, and I suspect they are bathyphylls, or intermediate between such and acrophylls. Both kinds are shown in Text-Fig. 32.

F. tulipifera nov. sp.

Text-Figs. 28, 29, 35.

F. callicarpae similis: *lamina* 3.4–6.8 × 1.2–3 cm., *elliptico-lanceolata*, medio latissima, *utrinque attenuata*, paullum inæqualis, vel curvata, subcoriacea, *apice acuta*, haud retusa, basi interdum minute cordata vel inæqualis, *margine apicem versus minute denticulata, costis lateralibus* utrinsecus 8–11, subtus prominentibus, costis basalibus 3, *areolis profunde piloso-foveolata:* petiolus 2–9 mm. longus. *Receptaculum cauliflorum, parvum, depresso-globosum*, 3.5 cm. latum, sparse pilosum, *maculis pallidis marmoratum: flores cecidiophori perianthii segmentis saepe 2–3 connexis vel omnino breviter connexis*, haud peltato-affixis.

Distr. Brit. N. Borneo.

Typus. Sing. F. No. 27763, leg C. E. Carr, Mt. Kinabalu.

A climber like *F. callicarpa*, the stems slender 5 mm. thick, (? full-grown) : bathyphylls?

The young twigs, petioles and edges and undersides of the leaves rather closely hairy with lax white spreading hairs up to 1.5 mm. long, the mature parts, especially the undersides of the leaves, glabrescent: uppersides of the leaves and *stipules glabrous.*

Leaf-blade 3.4–6.8 × 1.2–3 cm., *elliptic lanceolate*, broadest at the middle, *tapered gradually to each end, generally slightly asymmetric and falcate, the apex acute*, narrow but not acuminate, *not retuse*, the base attenuate, very narrowly cordate, often slightly asymmetric but never auricled, *the edge very finely denticulate*, especially towards the apex, subcoriaceous, not scabrid, bright dark green above, pale green with dark green reticulations beneath, drying rather undulate with the midrib and main veins sunk on the upperside, pale greyish brownish or greyish yellowish above and pale brownish beneath and minutely brown-dotted: *primary lateral veins* 8–11 pairs, *arising at a very wide angle from the midrib and passing almost straight out to the margin*, connected by a conspicuous arching marginal vein ca. 1 mm. from the edge, drying conspicuous, thick and pale brown: *secondary veins* arising from the midrib between the primaries and often almost as conspicuous: *tertiary veins* reticulate, very faint, *enclosing conspicuous deep hairy stomatal pits: basal veins* 3, the

lateral veins continued as the conspicuous marginal veins: *petiole* 2–9 × 1 mm., brown, becoming scurfy-flaky: *stipules* 4–14 mm. long, conical, fairly persistent, glabrous even when young.

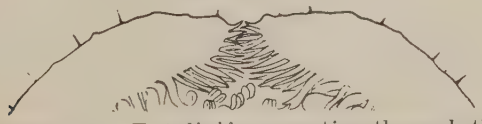
Receptacles on short, woody, bracteate tubercles on the main creeping stem, solitary: *body* 3 cm. long, 3.5 cm. wide, depressed globose, the distal end flattened, not umbonate, pimply with small lenticels, *sparsely pilose with erect, hispid, white hairs* up to 1 mm. long, olive green with paler, cream mottling (unripe): *neck* 8 × 4 mm., distinct: *peduncle* 0: *basal bracts* 3, triangular, acute, scarcely spreading, glabrous, 2–3 mm. long: *orifice* 2 mm. wide, circular, slightly depressed and surrounded by a faint, narrow, raised rim, closed by 3 apical bracts slightly raised into a low cone: *internal bristles scarce, very inconspicuous,* up to 1 mm. long.

Male flowers 9–13 mm. long overall; stalk white, much curved: *perianth* 2 mm. long, wine-red, gamophyllous to the middle, with 3, in some cases 4, rarely 5, blunt lobes: *stamens* rarely 2, immature, the anther 1.5 mm. long and half-exsert.

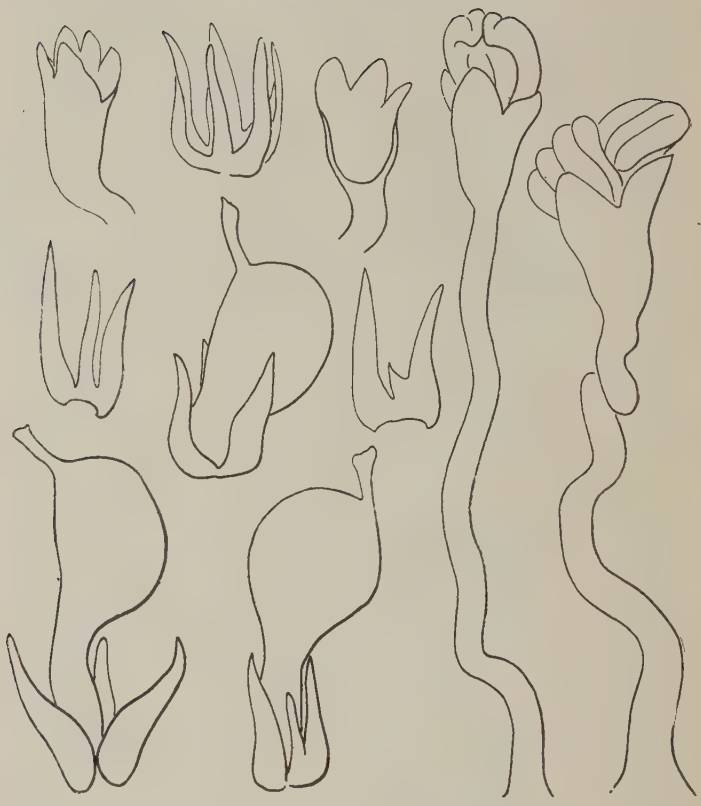
Gall-flowers 3–5.5 mm. long overall, sessile: *perianth* of 3–4, occasionally 5, lanceolate, entire, subgelatinous, wine-red segments 2–2.8 mm. long, strongly thickened at the base, 2–3 often shortly gamophyllous at the base, in some cases appearing as if there were 1–2 free segments and one deeply 2–3–fid segment, with simple transverse linear attachment: *ovary* with a short or rather long stalk: *style* ca. 1 mm. long.

I describe this species from dried twigs and an apparently full-grown but immature receptacle attached to a leafy twig in spirit. The emergence of the stamen shows that the fig, which is unusually small for Synœcia, must be almost or quite full-grown. The specific epithet refers to the appearance of the male perianth.

The species comes very close to *F. callicarpa* but the perianth of the gall-flower, the acute apex of the leaf, its denticulate edge and the many primary lateral veins prevent one from making it a variety of that species. It is also close to *F. cataupi* which has fewer primary lateral veins and scabrid leaves as well as the perianth of *F. callicarpa.* (But see the remarks under *F. callicarpa*).



Text-Fig. 28 *F. tulipifera:* section through the orifice of a gall- receptacle of the type-collection: × 2.



Text-Fig. 29 *F. tulipifera:* mature gall-flowers and their perianths, and 2 mature male-flowers with 2 cut-open perianths (upper middle and left) from the type-collection: × 10.

Summary

Thirteen species and four varieties are described, the following as new:—*F. barba-jovis, F. Carri, F. dens-echini, F. grandiflora, F. tulipifera, F. callicarpa* var. *parvifolia,* var. *crassinervia,* var. *angustifolia,* var. *multinervia.*

F. megacarpa is reduced to *F. callicarpa* as var. *parvifolia. F. trachycoma* is raised to specific rank. *F.*

aurantiaca, F. Simiae and *F. singalana* are doubtful species. The Philippine specimens referred to *F. apiocarpa* are *F. Scratchleyana. F. antoniana, F. areolata, F. brunnea, F. Warburgii,* referred to Synœcia, are Eusyce. *F. Johnsoni,* referred to Synœcia, is Urostigma. *F. callicarpa* is hardly to be distinguished specifically from *F. punctata.*

Synœcia is a natural subgenus of closely allied root-climbers, the more advanced species being among the most highly specialised developments of Ficus. It is important to recognise *a.* the distinction between bathyphylls (leaves on creeping stems) and acrophylls (leaves on the free-hanging, subærial stems). *b.* the presence or absence of stomatal pits on the underside of the leaves. *c.* the position, the colour and the structure of the orifice of the receptacles.

A natural and artificial classification of the species is given.

Synœcia is limited to Malaysia with Burma, ? Indo-China, Formosa, New Guinea, Timor, Java, and Sumatra as its limits. Its greatest development is in Borneo whence it seems to have spread. The five new species were all found in N. Borneo.

It seems that animals do not eat the large, brightly coloured receptacles, so that species of Synœcia are without special means of dispersal.

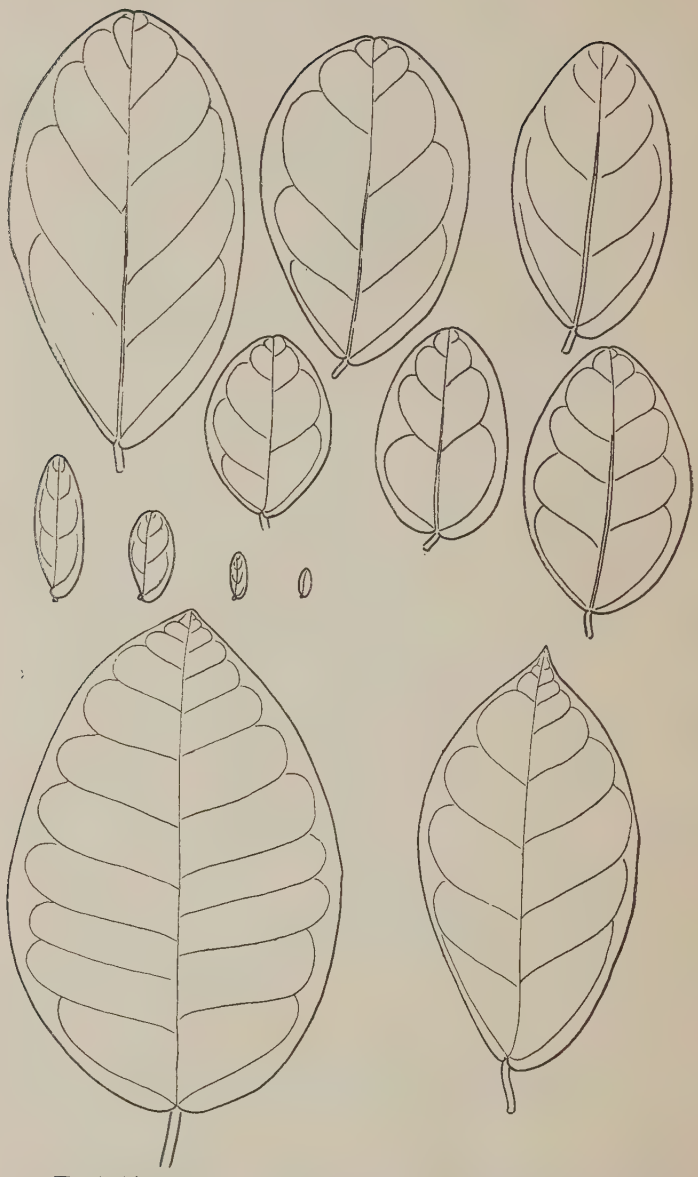
Drawings are given of the flowers and leaves of all species and, in many cases, of the orifice of the receptacle.

References

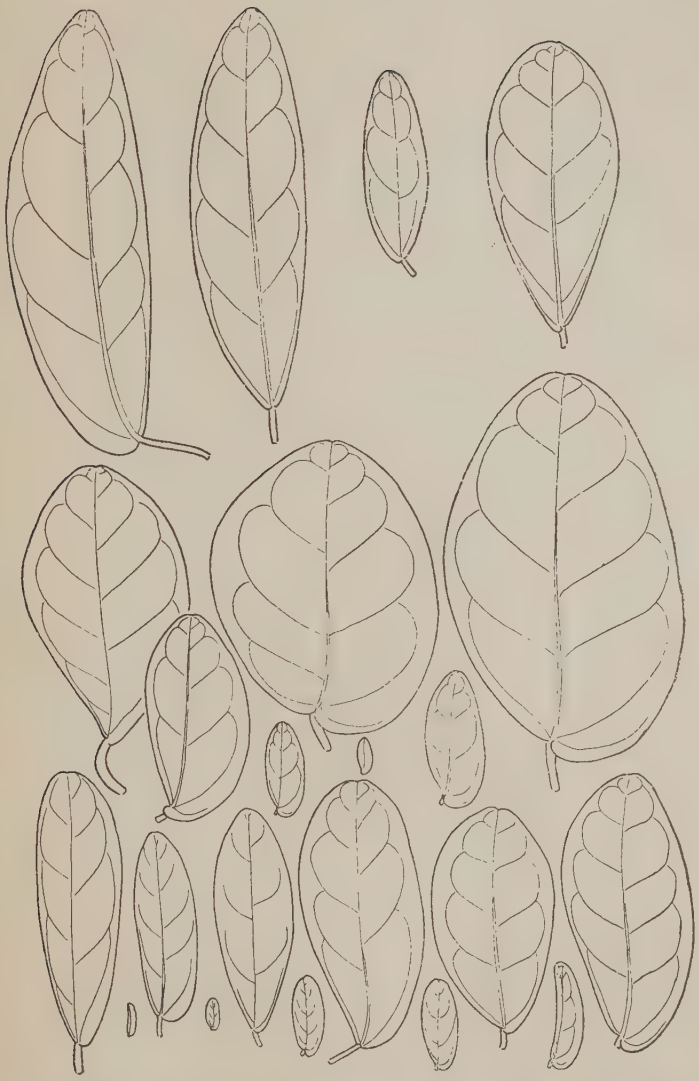
1. Corner, E. J. H. A revision of the Malayan Species of Ficus; Covellia and Neomorphe. Mal. Br. Roy. As. Soc. XI, *1933,* 1.
2. Holttum, R. E. On Stenochlæna, Lomariopsis, and Teratophyllum in the Malayan Region. Gard. Bull. S.S. V. *1932,* 246.
3. ————. Further notes on Stenochlæna, etc. ibid. IX, *1937,* 139.
4. King, G. The Species of Ficus. Ann. Roy. Bot. Gard. Calc. II. *1888,* and Appendix.
5. Sata, T. Systematic Status of the genus Ficus. Journ. Jap. Bot. X. *1934,* 343.

Text-Fig. 30 *F. callicarpa* typical: bathyphylls and acrophylls: nat. size.

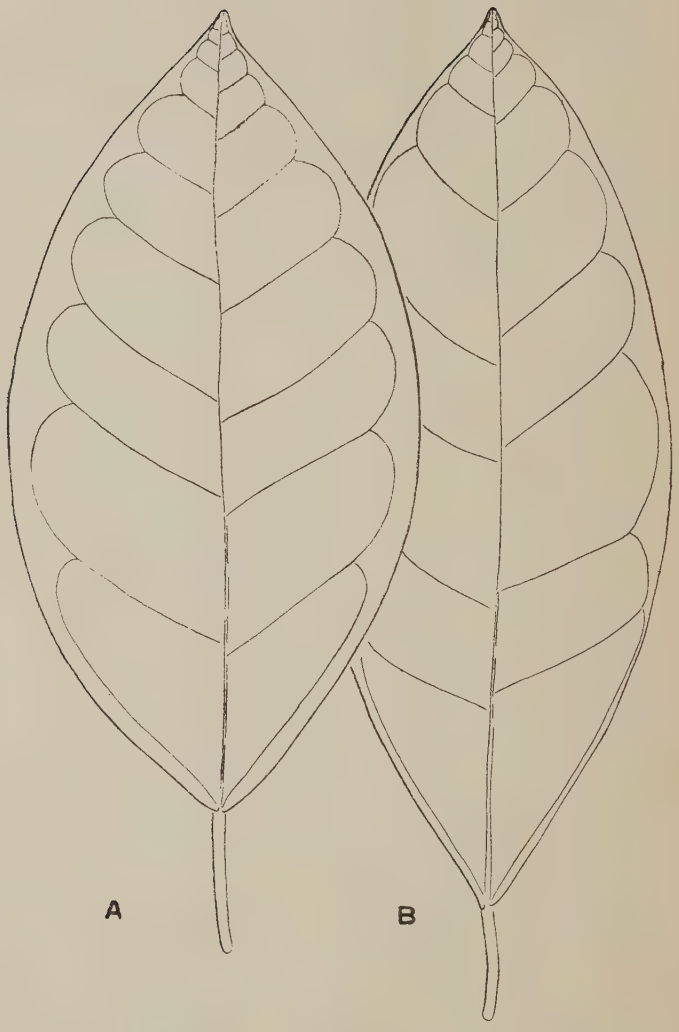
Text-Fig. 31 *F. callicarpa* typical: a, Lorzing 7258; b, Wray 2022: nat. size.



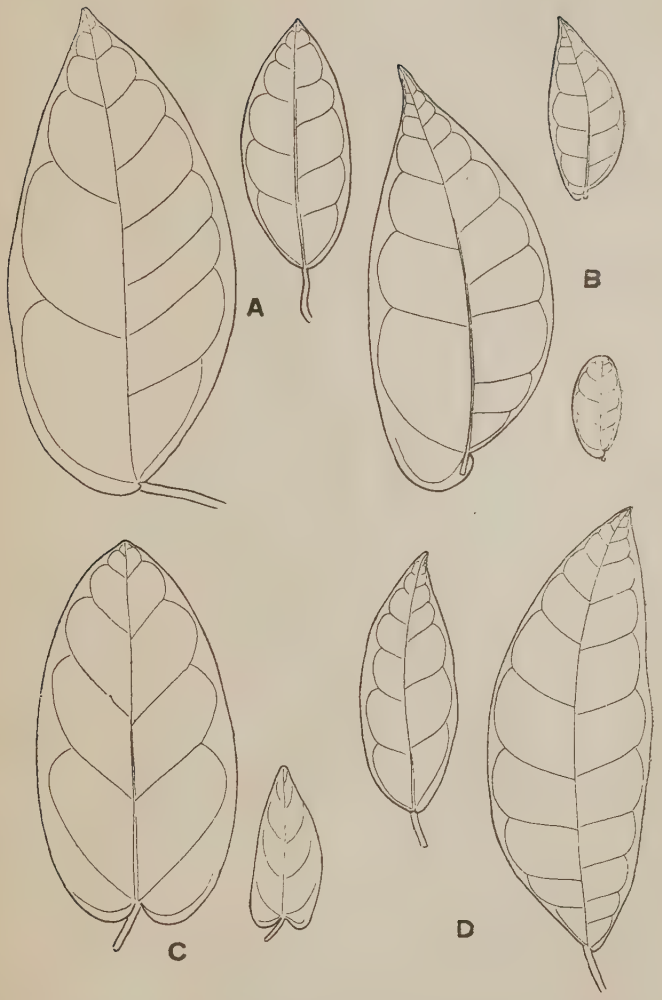
Text-Fig. 32 *F. callicarpa parvifolia* (above), bathyphylls and acrophylls: *F. trachycoma* (below), acrophylls: nat. size.



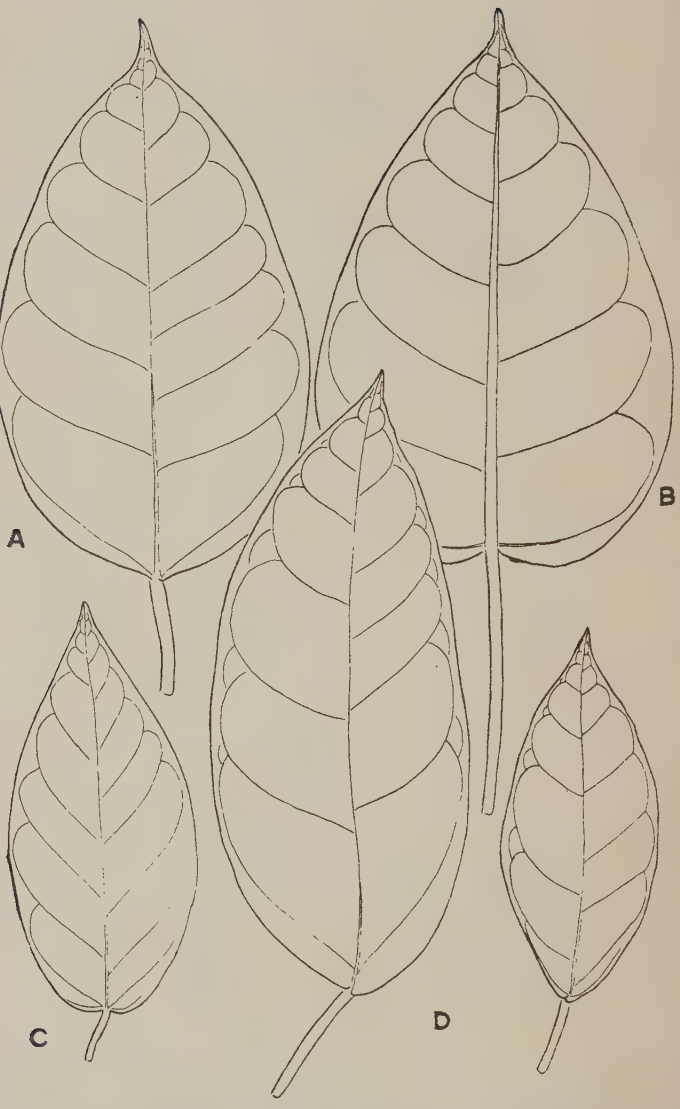
Text-Fig. 33 *F. callicarpa angustifolia* (above) acrophylls: *F. callicarpa crassinervia* (middle), bathyphylls and acrophylls: *F. punctata* (below) bathyphylls and acrophylls: nat. size.



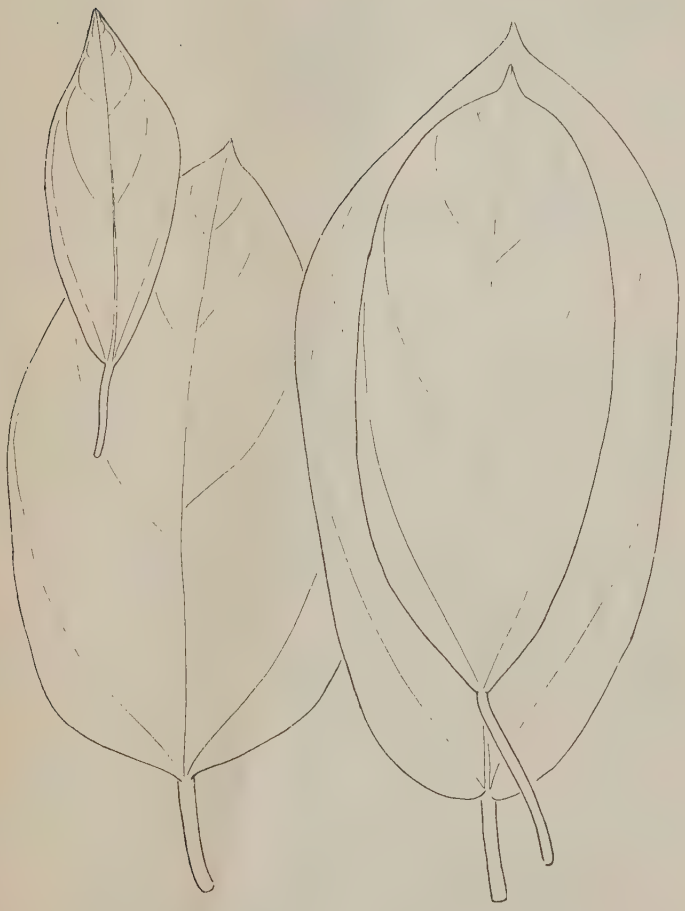
Text-Fig. 34 *F. callicarpa multinervia,* acrophylls: nat. size.



Text-Fig. 35 *F. cataupi*, **a**, 2 leaves: *F. barba-jovis*, **b**, 3 leaves: *F. tawaensis*, **c**, 2 leaves: *F. tulipifera*, **d**, 2 leaves: nat size.



Text-Fig. 36 *F. Scratchleyana,* **a,** (Philippine): *F. dens-echini,* **b**: *F. Bordenii,* **c**: *F. Carri,* **d,** 2 leaves: ½ nat. size.



Text-Fig. 37 *F. apiocarpa*, ½ nat. size.

VALIDATING BOTANICAL NAMES BY REFERRING TO INVALID LITERATURE

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1. Introduction

Two recent papers, one on *Epipogium* by Dr. T. A. SPRAGUE and Miss M. L. GREEN (*Kew Bull.* 1937, pp. 475–476) and the other on *Pterocarpus* by Mr. H. K. AIRY-SHAW (*Kew Bull.* 1937 pp. 477–479), have created what seems to me to be an undesirable precedent for validating botanical names by reference to pre-1753 literature. This procedure, at one time considered legitimate, was later rejected in order that the Linnean genera might retain the sense given to them in *Species Plantarum* ed. 1 (1753)—often an impossibility if reference by LINNAEUS to pre-1753 literature were admitted as valid. That to revert to this procedure now would violate the provision of the Rules of Botanical Nomenclature (ed. 3, 1935) and lead to many difficulties is clearly demonstrated by a consideration of the two above-mentioned cases.

2. The Case of Epipogium

In the remarks following the description of the new genus *Gastrodia*, published in *Prodromus Florae Novae Hollandiae* (1810 p. 330) ROBERT BROWN, the author of the work, observes as follows:—

> "Affinitatem haud levem habet cum *Epipogio* (quod *Limodorum Epipogium* Sw.,) præsertim Anthera decidua ....."

Again, on p. 331 of the same work and under the new genus, *Dipodium*, the same author makes the following statement:—

> "....; de *Epipogio* GMEL. jam dictum est."

Now Dr. SPRAGUE and Miss GREEN (*Kew Bull.* 1937 pp.

475–476) regard these two statements of R. BROWN as constituting, when joined together, "the first valid publication" of the genus *Epipogium*. They argue as follows:—

> "There [in R. BROWN'S *Prod.* pp. 330 and 331] it is unaccompanied by a description, but *Epipogium* is attributed by R. BROWN, on p. 331, to GMELIN, who gave the generic description under the spelling *Epipogium* (Fl. Sibir. I, 11: 1747). The citation of GMELIN by ROBERT BROWN is an *implicit* reference to GMELIN'S previously and effectively published description, and accordingly validates the name *Epipogium* R.BR. under the International Rules, Art. 37 ....."
>
> "The case of *Epipogium* illustrates the point that, under the International Rules, the citation of a previously and effectively published description of a genus need not include a precise reference to its place of publication, so long as there is no reasonable doubt as to the work intended."

3. The Case of Pterocarpus

In *Kew Bulletin* (1937 pp. 477–479) Mr. AIRY-SHAW discusses the genus *Pterocarpus* published by JACQUIN (*Sel. Stirp. Amer. Hist.* 1763, p. 283). According to Mr. AIRY-SHAW, JACQUIN gave neither description nor generic citation, but referred under the specific name *P. officinalis* to "Linn. mat. med. 522" (*i.e.* LINNAEUS'S *Materia Medica*, 1749 p. 522 where the name *Pterocarpus* occurs). In this work there is no generic description of *Pterocarpus*, but there are references to previous literature. Mr. AIRY-SHAW concludes therefore:—

> "JACQUIN'S reference to LINN. Mat. Med. constitutes an indirect citation, since LINNAEUS there refers back to his Fl. Zeyl. where a description of *Pterocarpus* was 'previously and effectively published' ."

Mr. AIRY-SHAW then explains how *Pterocarpus* of *Flora Zeylanica* is a mixture of *Daemonorops* (palm), *Derris* and *Pterocarpus*, so that it is a *nomen confusum*. He therefore proposes that it should be listed in *Appendix* V which is being prepared under the provisions of Art. 64 of the Nomenclature Rules.

4. Objections Stated

The objections *a-b* apply to the case of *Epipogium* only, while objections *c-e* apply to both the cases.

(*a*) It is unreasonable to oblige a reader to look to the observations made under two different genera (*Gastrodia* and *Dipodium*) in order to find out whether or not a third genus (*Epipogium*) has been validly published. For if this were to be regarded as permissible procedure,

then it would mean that a genus could be validly described piecemeal in several places, though each part by itself would be invalid.*

(*b*) The second objection seems to violate the new legislation concerning Provisional Names, adopted at the Amsterdam Congress (1935) which ordains as follows:—

> "A name proposed provisionally (nomen provisorium) in anticipation of the group, ..., or *merely mentioned incidentally is not validly published.*"

I submit that both the references made by ROBERT BROWN to *Epipogium*, whether taken individually or together, ought to be included under the clause italicized. If the clause does not apply to such cases, its wording is ambiguous and its meaning should be more precisely defined.

(The only definite reference made under *Epipogium* by ROBERT BROWN is to *Limodorum Epipogium* SW. but that reference, according to Dr. SPRAGUE and Miss GREEN'S treatment of the case, did not validate the genus *Epipogium*).

(*c*) Dr. SPRAGUE and Miss GREEN invoke Art. 37 in support of their contention that the references given by them constitute "the first valid publication" of the genus *Epipogium*. But Art. 42 deals expressly with the validity of generic names: it reads as follows:—

> "A name of a genus is not validly published unless it is accompanied (*1*) by a description, or (*2*) by the citation of a previously and effectively published description of the genus under another name; or (*3*) by a reference to previously and effectively published description of the genus as a subgenus, section or other subdivision of a genus."

Now neither Dr. SPRAGUE and Miss GREEN, nor Mr. AIRY-SHAW, have claimed validation for either of the genera (*Epipogium* and *Pterocarpus*) under Art. 42 (1) or Art. 42 (3). Mr. AIRY-SHAW claims validation of the genus *Pterocarpus* [L] JACQ. (1763) under Art. 42 (2), but neither he nor Dr. SPRAGUE and Miss GREEN have shown that the descriptions referred to under either *Epipogium* or *Pterocarpus* were published "under another name."

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* I do not know why Dr. SPRAGUE and Miss GREEN selected references made to *Epipogium* on pp. 330 & 331 (in R.BR., *Prodr. Fl. Nov. Holl.*) and omitted to consider the one on p. 310 which reads as follows:—

> "Hinc quatuor Swartzianis sectionibus quintam adjecimus, adhucdum parvulam, ad quam, præter *Gastrodiam*, pertinet *Epipogium* GMEL., perperam *Limodoris* asociatum."

In the copy I consulted all the three pages are indicated in the general Index of the work under *Epipogium*. The case, considered on this reference alone, would have been less weak, for the objection (*a*) would not have been applicable to it.

(*d*) *Epipogium* and *Pterocarpus* are said to have been validated by a reference to pre-1753 literature; but Art. 20 invalidates this literature.

If references to such invalid literature are permitted, what is the significance of the clauses in Arts. 20 and 42 which fix, for vascular plants, 1753–1754 as the starting-point of botanical nomenclature and the names of genera. These clauses run thus:—

> "It is agreed to associate generic names which appear in LINNAEUS'S *Species Plantarum* ed. 1 (1753) and ed. 2 (1762–63) with the first subsequent descriptions given under those names in LINNAEUS'S *Genera Plantarum* ed. 5 (1754) and ed. 6 (1764)." (Art. 20).
>
> "An exception is made for the generic names published by LINNAEUS in *Species Plantarum* ed. 1 (1753) and ed. 2 (1762–63) which are treated as having been validly published on those dates." (Art. 42).*

In the case of the old generic names (*e.g. Pterocarpus*) adopted in either of the two editions of LINNAEUS'S *Species Plantarum* these clauses would not only be superfluous but they would also be misleading, especially in regard to the words "first subsequent descriptions" in Art. 20; for all these old names would be valid by reference given by LINNAEUS to the literature invalidated under Art. 20.

Thus to accept as valid references to invalid literature, we would be violating the very principles which in 1905 obliged botanists to prohibit the Linnean genera adopted in *Species Plantarum ed. 1* from being interpreted on the references to literature invalidated under Art. 20 though previously, it seems, such interpretations had been advocated by A. DE. CANDOLLE, J. BRIQUET, O. F. COOK, OTTO KUNTZE and others. In fact, it is said that the startling changes advocated by KUNTZE in his *Revisio* (1891) were the principal cause bringing about *volte face* in the views widely held previously. J. BRIQUET (formerly a supporter of the other procedure) advised the Vienna Congress (1905) to choose 1753–54 instead of LINNAEUS'S *Genera Plantarum* ed. 1 (1737) or TOURNEFORT'S *Institutiones* (1700) (advocated previously by many botanists) as the starting-point of the genera under the binary system, a ruling altered at the Cambridge Congress (1930) in order to

* Here I may draw the attention of botanists to the fact that in splitting Art. 38 of 1910–Rules into Arts. 41 & 42 of the 1935–Rules, the clause containing the exemption to the generic names published in LINNAEUS'S *Species Plantarum* was placed under Art. 42, but its more appropriate place seems to be in Art. 41. In fact in the 1910 Rules this clause was placed immediately after the sentence which formed the basis, not of Art. 42, but of Art. 41, of the New Rules. I think this misplacement is one of the reasons why the significance of the exemption as well as of Arts. 20 and 41 is not fully appreciated.

include the genera in LINNAEUS'S *Species Plantarum* ed. 2 (1762–63), and embodied in the above transcribed clauses of Arts. 20 and 42.*

(*e*) If a genus can be established nomenclaturally by such slender means as that of *Epipogium* and *Pterocarpus* as suggested by Dr. SPRAGUE and Miss GREEN, and by Mr. AIRY-SHAW, then botanists may ask what is the purpose of the whole structure of nomenclature built up by the Rules. For references to such invalid literature, if permitted, would render the Rules ineffective and of no account for preventing procedures condemned under the Rules, and the mere registration in nomenclators like *Index Kewensis* of invalid genera, species, etc., published in utter disregard of the provisions regulating the description of botanical names, would have to be considered as constituting valid publication by reference.

5. Examples

(*1*) In *Species Plantarum* ed. 1 (1753, p. 443), LINNAEUS published several species under *Rhizophora* but did not give a generic description. The name *Rhizophora* was published by LINNAEUS seven years earlier in his *Flora Zeylanica* (1747, p. 181), where it was apparently used both as a "generic" and a "specific" name. (I have not been able to consult this work; my information is indirect). The species described in *Flora Zeylanica* was named *Rhizophora conjugata* in *Species Plantarum*, a reference being given to *Flora Zeylanica*. No other species described in *Species Plantarum* had previously been referred to *Rhizophora*.

Hence, if references to literature invalidated under Art. 20 were permitted under the Rules, then the genus *Rhizophora* would be valid, not because of the exceptional privileges accorded to the Linnean genera in Arts. 20 and 42.

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* The following statement of Mrs. VERA HIGGINS in her book "*The Naming of Plants*" London (1937) is erroneous as far as the starting-point of genera is concerned: "..... his [LINNAEUS'S] two books 'Genera Plantarum' (1737) and 'Species Plantarum' (1753) have been taken as the starting-point of modern nomenclature" (p. 46). In the reviews I have seen of this book, this error has not been pointed out.

A few pages later Mrs. HIGGINS makes a statement which, though not conveying the full force of the legislation on the point, comes very much nearer the truth:

"..... at the International Botanical Congress at Vienna in 1905 it was finally agreed that only names published in LINNAEUS'S 'Species Plantarum' or subsequently should count; thus 1753, the date of publication, was made the artificial starting-point for modern nomenclature, and though earlier names might be consulted if necessary, they were not considered valid if they differed from those given by LINNAEUS". (p. 48).

but because of the explicit reference to *Flora Zeylanica* given by LINNAEUS under *R. conjugata*, and the genus would therefore have to be interpreted by reference to *R. conjugata*, the only species described in *Flora Zeylanica*.

This would mean that the lectotype (*R. mangle* L) selected in *Supplementum* II of the Rules would have to be rejected as untenable, that *Rhizophora* would become synonymous with *Bruguiera* LAM. (1796), the type of the latter being *R. conjugata* L., and that what now passes as *Rhizophora* L. would require a new name.

It might be argued that, according to *species lectotypicae* of the Linnean generic names (International Rules ed. 3 pp. 139–143), the genus *Rhizophora* must be interpreted with reference to *R. mangle* L. the standard or lectotype species indicated for the genus as used in *Species Plantarum* (1753). But the answer would be that, according to the resolution made at the Amsterdam Congress, 1935 (*Proceedings* I, 1936 p. 366), those lectotype species need not be adopted by botanists if "there is clear reason for rejecting any species in favour of another". Thus those who maintain that references to invalid literature are permitted under the Rules, would be able to offer, as one very clear reason for rejecting *R. mangle* L. in favour of *R. conjugata* L., the fact that the taxonomic group indicated by the latter is the only one included under *Rhizophora* of LINNAEUS'S *Flora Zeylanica* (*l.c.*), so that no other species could be selected as the type of a genus validated by a reference to *Rhizophora L.* of *Flora Zeylanica*. On the other hand, if my contention is admitted and references to invalid literature are rejected for the purpose of validating a name, then *R. mangle* L. can be accepted as the lectotype species of *Rhizophora* L. as published in 1753.

(*2*) Assuming that the references to pre-1753 literature were valid, Mr. AIRY-SHAW showed that *Pterocarpus* [L.] JACQ. (1763) was a *nomen confusum* to be rejected under Art. 64. But, notwithstanding this rejection, *Pterocarpus* L. (*Sp. Pl.* ed. 2: 1763) would become a later homonym of *Pterocarpus* JACQ., and therefore, according to Art. 61, a non-legitimable name. If *Pterocarpus* L. (1763) was conserved against *Pterocarpus* JACQ., then the former would again be found to be a *nomen confusum*, because in *Species Plantarum* ed. 2 (1763) LINNAEUS quoted, besides LINN. *Mat. Med.* and JACQUIN'S description of *Pterocarpus officinalis*, also *Lingoum* RUMPH., *Amboin.* II (p. 205 t. 70) and *Draco Arbor* LOEFL. *it.* (266: 273 n. 147: 168).

If these references were held to have validated the genus, one could not go to LINNAEUS'S *Genera Plantarum* ed. 2 (1764) to interpret the genus already validated a year

earlier in *Species Plantarum* ed. 2. (1763) by the same or similar references used by JACQUIN, and one would have to discard also *Pterocarpus* L. (1763) as a *nomen confusum*.

But if reference to *Flora Zeylanica* was permissible, then one could claim that the genus *Pterocarpus* [L.] was validated by BURMANN in his *Index* to RUMPHIUS'S *Herbarium Amboinense* published in 1755 (p. 11) by reference to *Lingoum* RUMPH. (on one side) and *Flora Zeylanica* (on the other). This would render the rejection of *Pterocarpus* JACQ. in order to conserve *Pterocarpus* L. (1763) unnecessary, because both of these names would be later homonyms of *Pterocarpus* L. *ex* BURMANN (1755).

With equally good reason it could be claimed that *Lingoum* RUMPH. *ex* BURM. (*Index,* 1755) and not *Pterocarpus* L. *ex* BURM. was the legitimate name for the genus, and that it included three distinct species: *L. rubrum* RUMPH., *L. molle* RUMPH., and *L. saxatile* RUMPH., all validated through explicit or implicit references by BURMANN in the aforementioned *Index*. It would follow that these binomials would have priority both over *P. officinalis* and *P. Draco,* and that ADANSON (*Fam.* II, 1763, p. 319) would have been right in adopting *Lingoum* as the legitimate name for the genus.

(*3*) An incursion into pre-1753 history of the use of *Lobelia*, a name adopted by LINNAEUS as a generic name in his *Species Plantarum* (1753) would also yield similar results. The earliest use of the name *Lobelia* prior to 1753 is by PLUMIER (*Gen.*, 1703 p. 21, t. 31). Now if one were to interpret *Lobelia* L. (1753) with reference to *Lobelia* PLUM. (1703) to which LINNAEUS referred under *L. Plumieri* L. (1753), *Lobelia* L. would become synonymous with *Scaevola* L. (GOODENIACEAE); consequently the lectotype-species indicated in the Rules for the genus as a member of LOBELIACEAE would become useless for the genus as a member of GOODENIACEAE. Should this be granted, then under Art. 66 the family name LOBELIACEAE *quoad genus typicum* would be a synonym of GOODENIACEAE, and LOBELIACEAE *ex altera parte* would require a new name. According to my contention the history of *Lobelia* as a valid genus started in 1753; and the types of descriptions and names published prior to 1753 are really "prehistoric" as far as the valid plant-nomenclature is concerned. It is a misnomer to label a specimen, described in literature condemned by the Rules, as a "historic type" of a valid genus merely because, when the genus was being validated, an implicit or explicit reference was made to a previous invalid description or name. Much confusion has been created both by calling such types "historic" and by focussing on

them an undue attention. When recommending lectotype-species for the Linnean genera, neither the late Dr. A. S. HITCHCOCK, nor Miss GREEN attached any importance to the "historic" types; in fact, in typifying *Lobelia,* Miss GREEN rejected the "historic type" and recommended *L. cardinalis* L. (1753) as the lectotype-species for the genus (*International Rules* 1935). Had they followed Mr. AIRY-SHAW'S procedure, they would have found that a great number of Linnean genera would have to be proposed as *nomina confusa.* The procedure of ignoring the "historic type", though opposed to the contention of Dr. SPRAGUE, Miss GREEN and of Mr. AIRY-SHAW, is entirely in accord with my interpretation of Art. 20, and with my contention concerning the value, in nomenclature, of references to invalid literature.

Such a result was no doubt foreseen by the legislators who met at the Vienna Congress in 1905 and invalidated the botanical literature published previous to the year 1753, fixing 1753–1754 as the starting-points for the genera of vascular plants, even for those genera which LINNAEUS had published before 1753 and adopted in his *Species Plantarum* ed. 1753.* The reference back, if admitted, may take us not only to LINNAEUS'S own works published before the year 1753, but also to others including PLINY, THEOPHRASTUS and MOSES; and the whole force of the ruling of Art. 20 would be lost.

The above instances clearly demonstrate "some curious anomalies and complexities" (to quote the phrase of Mr. AIRY-SHAW) which will have to be faced if references to literature invalidated under Art. 20 are even admitted.

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* That LINNAEUS in preparing his *Species Plantarum* (1753) changed the interpretation of many old names or relegated them to synonymy in order to make room for the new ones, was well known even to his contemporaries: "I have had pleasure", wrote PETER COLLINSON in a letter dated 20th April 1754 and addressed to LINNAEUS, "of reading your *Species Plantarum,* a very useful and laborious work. But, my dear friend, we that admire you are much concerned that you should perplex the delightful science of botany with changing names that have been well received, and adding new names quite unknown to us. Thus botany, which was a pleasant study and attainable by most men, is now become, by alterations and new names, the study of a man's life, and none now but real professors can pretend to attain it. As I love you I tell you our sentiments." And again writing after the appearance of the 5th edition of LINNAEUS'S *Genera Plantarum* (1754), in a letter dated 10th April 1755, COLLINSON said: "You have begun by your *Species Plantarum;* but if you will forever be making new names, and altering good and old ones, for such hard names that convey no idea of the plant, it will be impossible to attain to a perfect knowledge in the science of botany."

6. Conclusions

Applying the terms valid and invalid as precised by me in *Gard. Bull. Straits Settl.* IX *Part.* 3 (1937) to literature and references in order to indicate whether or not they are counted botanically, and from the foregoing discussions we may deduce the following:—

i. LITERATURE is *valid* only if it is counted botanically. Otherwise it is *invalid.*

ii. LITERATURE in order to be *valid* must not only be *effective* under Art. 36 but also *satisfy other conditions* explicitly or implicitly laid down as essential in the Rules.

iii. LITERATURE which botanists have to disregard because of the special ruling in Art. 20 should be *invalid.*

iv. No *Botanical Name* can be admitted as *valid* unless (*1*) it satisfies the conditions laid down as essential for the word or words constituting the name itself, and (*2*) it is accompanied by either (*a*) a valid description, or (*b*) a valid reference (*see* below **v**).

(In certain circumstances a plate with analyses is accepted as equivalent to a valid description. cf. Arts. 43 and 44).

v. A REFERENCE is *valid* when it refers to a description published both in valid literature, and in accordance with the rules laid down as essential for the words constituting the description.

vi. Consequently ALL REFERENCES TO INVALID LITERATURE, even when they include plates, should be *inadmissible* under the Rules.

vii. SEVERAL NAMES (formerly ignored but recently resurrected and made the bases of many nomenclatural changes) whose sole claim for validity is that they were referred to a plate or description in invalid literature should be *invalid: e.g.*

(*1*) In O. STICKMAN'S Dissertation on RUMPHIUS'S *Herbarium Amboinense* eds. 1754 and 1759, accepted as valid by Dr. E. D. MERRILL (*Interpr.* RUMPH. *Herb. Amboin.* 1917).

(*2*) In BURMANN'S *Index* to RUMPHIUS'S *Herbarium Amboinense* eds. 1755 and 1769, accepted as valid by Dr. MERRILL (*cf. op. cit.*).

(*3*) In ROXBURGH'S *Hortus Bengalensis* (1814), accepted as valid by the late Dr. C. B. ROBINSON (*Philipp. Journ. Sci.* VII, 1912, pp. 411–419) because ROXBURGH had referred under the names to plates in RUMPHIUS'S *Herb. Amb.*

(4) In MOON'S *Catalogue of Indigenous and Exotic Plants of Ceylon* (1824) accepted as valid by Mr. A. H. G. ALSTON (*Ann. Roy. Bot. Gard. Peradeniya* XI, 1929 pp. 203–205) because they contain references to the plates or descriptions either in RHEEDE'S *Hortus Malabaricus* or in RUMPHIUS'S *Herbarium Amboinense.*

(5) Several generic and specific names listed in nomenclators and *Index Kewensis* with references to invalid descriptions, whether or not published in valid publications.

viii. THE NAMES IN PRE-1753 LITERATURE (and in fact in all invalid literature) must be given the same status and treatment as the names *in scheda.* No one who adopts the name of a manuscript species need consider the types studied by the author of the manuscript name (*chironym*). The botanist who validates the name is free to choose his own types, even to the extent of ignoring entirely the specimen on which the manuscript name was noticed. The mere fact that the author of the manuscript name and the herbarium wherein the name was found have been quoted, must not be taken as the sure indication that the types of the manuscript name are to be included in typifying the name as published by the second botanist. This principle is likewise applicable to references to invalid literature. In using an invalid name the older botanists frequently quoted the invalid reference, not because they adopted any of the types of invalid name, but because they wanted to indicate the persons responsible for coining or using the name previous to its actual valid publication; the citation of the invalid literature did not necessarily mean that the original sense was retained in the name as newly instated. Hence the value of the legislation which, besides invalidating pre-1753 names, fixed 1753–1754 as the starting point of nomenclature not only of species but also of genera, of vascular plants (*cf.* Arts. 20 and 42).

ix. *Pterocarpus* JACQ. (1763), *Pterocarpus* BURMANN (1755) and *Epipogium* R. BR. (1810) are consequently *invalid* names.

x. *Pterocarpus officinalis* JACQ. (1763) which is accepted by Mr. AIRY-SHAW (*Kew Bull.* 1937 p. 63) both as valid and as legitimate is *invalid* because the specific epithet was published under an invalid generic name, and, therefore, cannot be included in considerations of priority.

xi. *Pterocarpus* L. (1763) is a *valid* generic name because of the exceptional privileges conceded under Arts. 20 and 42 to the generic names used in *Species Plantarum* eds. 1 and 2.

xii. *Pterocarpus Draco* L. (1763) rejected by Mr. AIRY-SHAW (*Kew Bull.* 1937 p. 63) as a superfluous name of *P. officinalis* JACQ. (1763) is both a *valid* and a *legitimate* name for the lectotype of the genus *Pterocarpus* L. (1763).

7. Appendix

From the quotation by Dr. SPRAGUE and Miss GREEN of the bibliography and synonymy of *Epipogium*, and from the bibliography of the species as given in *Index Kewensis*, it seems that the rejection of *Epipogium* GMEL. *ex.* R. BR. (1810) as invalid would entail no changes, other than orthographical, in the names of the genus and of the species retained under it. However, if the general rejection of references to invalid literature should require changes in the long accepted nomenclature of many genera comprising several species, then such changes could be prevented by placing the genera in *nomina generica conservanda;* but no such decision should be made before the actual need for such a conservation has been fully demonstrated.

THE TYPIFICATION OF BOMBAX, GOSSAMPINUS AND SALMALIA

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1. Introduction

In *Species Plantarum* (1753) under the generic name *Bombax*, LINNAEUS described three species: *B. Ceiba*, *B. pentandrum* and *B. religiosum*. The last two were soon transferred to two different genera, *Ceiba* and *Cochlospermum*, yielding the new combinations *Ceiba pentandra* (L) GAERTN. and *Cochlospermum religiosum* (L) ALSTON respectively. No one has disputed these transferences; consequently the genus must be typified on *B. Ceiba* L., the only original species now remaining in it.

But this view concerning the typification has been contested as illicit, and moreover it goes against the lectotype-species recommended in the Rules. Now this lectotype-species, *B. malabaricum* DC., was published in 1824, many years after the genus and its original three species; and if it is accepted as the lectotype for the genus, botanists will have to reject *Bombax* L. (1753) sensu strictissimo with *B. Ceiba* L (1753) sensu stricto as the lectotype, and to accept *Bombax* L. (1753) sensu International Rules (1935) with *B. malabaricum* DC (1824) as the standard species. A claim has also been made that, though *Salmalia* SCHOTT et ENDLICHER (1832) and *Gossampinus* HAM. (1827) are rival names to *Bombax* L. (1753) sensu International Rules (1935), there are no such rival names for *Bombax* L. (1753) sensu strictissimo with *Bombax Ceiba* L. as the lectotype, except *Eriotheca* SCHOTT et ENDL. (1832) and *Bombacopsis* PITT. (1916), which generic names, apart from their being little used and younger than *Bombax*, cannot be considered as being absolute synonyms of *Bombax* L. *sensu strictissimo*. Since any change in the lectotype-species of *Bombax* affects the nomenclature of some species and genera of Malayan importance, I have enquired into the typification of the genera *Bombax*, *Gossampinus* and *Salmalia*.

The results show:—

(*1*) that the typification of *Bombax* made by SCHOTT and ENDLICHER (*Metel.* 1832), and later by Dr. BAKHUIZEN (*Bull. Jard. Bot. Buitenz.* VI, 1924, pp. 161–240), is the correct one;

(*2*) that the typification recommended in the Rules cannot be accepted;

(*3*) that, unless the evidence produced below is wrong, the name *Gossampinus* cannot be maintained except as a synonym of *Ceiba;*

and (*4*) that *Salmalia* SCHOTT et ENDL. (1832) is the legitimate name for *Gossampinus* HAM. sensu BAKHUIZEN (1924). The reasons for these conclusions are set forth below.

2. The Lectotype Species of Bombax

In the Rules of Botanical Nomenclature ed. 3 (1935 p. 139) there is incorporated a proposal which advises botanists to make *Bombax malabaricum* DC. (= *B. Ceiba* L. *partim*) as the lectotype of the genus. But as, according to resolution passed at the last Botanical Congress, Amsterdam (1935), all the lectotype-species indicated in the Rules must "be adopted by botanists unless there is clear reason for rejecting any species in favour of another," I propose first to deal with the principal reasons which show why *B. malabaricum* DC. cannot be accepted as the lectotype for *Bombax* L. (1753). In order that the reader may follow my arguments better, I transcribe here the proposal as made originally by Miss M. L. GREEN in *Proposals by British Botanists* (1929 p. 160) to which book the Rules refer:—

> "580 **Bombax L.** Sp. Pl. 511; Gen. Pl. ed. 5: 227.
> "*B. malabaricum* DC. (*B. Ceiba* L. partim), the only element of *Bombax* L (1753) still retained in the genus. *Bombax Ceiba* L. sensu stricto and *B. pentandrum* L. are synonyms of *Ceiba pentandra* (L) GAERTN. and *B. religiosum* L. is *Cochlospermum Gossypium* DC."

Now when Art. 51 says that "when a genus is divided into two or more genera, the generic name must be retained for one of them," it has generally been taken to mean that, in typifying a genus, at least one of the original species has to be retained under it and that the name or the epithet of the species has also to be retained unless there is an intrinsic defect in the name or the epithet itself, which makes the name or its epithet either invalid, or non-legitimable. This interpretation of the Article is re-inforced by the ruling in Art. 18 which ordains that a genus must be typified on one of the original species (= constituent elements) and that the name of a taxonomic group must be changed if the type of that name is changed.

The striking novelty in Miss GREEN'S proposal, therefore, is that it obliges botanists to consider, in typifying *Bombax* L (1753), not any one of the three original species published in *Species Plantarum* (1753), but a species (*B. malabaricum* DC., 1824), published several years after the validation of the genus. The only relation of the suggested lectotype-species with the original genus is that the lectotype-species included as one of its syntypes a drawing quoted by LINNAEUS under the original species *B. Ceiba*, though the drawing is now excluded from the typification of *B. Ceiba*. If this novel procedure is admitted as licit, then it would mean that one could transfer the holotype or lectotype of one species to another and yet retain the specific name for the residual paratype or syntype which clearly did not form the basis of the species. Such a procedure, if admitted, would render Arts. 18, 51 and 52 utterly valueless or would give them only the force of recommendations.

Miss GREEN'S proposal, therefore, violates the very fundamentals of the type-concept, which, together with the priority-concept, are regarded as the very essence of the new Rules as adopted at the Cambridge Congress (1930) and later confirmed at the Amsterdam Congress (1935); consequently the lectotype-species indicated in the Rules for the interpretation of the genus *Bombax* cannot be accepted.

However if great nomenclatural changes would result by typifying *Bombax* on *B. Ceiba* L. sensu stricto, then the changes could be prevented not by selecting a lectotype-species in violation of the very fundamental principles of the Rules, but either by selecting another one of the original species, or if, as is in this case, that is impossible, by taking advantage of the provision in Art. 21 thereby rejecting *Bombax* L. (1753) and conserving *Bombax* DC. (1824) with *B. malabaricum* DC. as the lectotype. A third alternative would be the rejection of the present typification of *B. Ceiba* L. and the typification of it in a way that would bring about the least possible disturbance in the accepted nomenclature; but in my opinion it would be a bad precedent to reject, by legislation, a long accepted typification of a species in order to interpret it anew.

It may be observed here that the case of *Bombax* is, to a certain extent, comparable with that of *Ixia* L. typified by the late Dr. A. S. HITCHCOCK (*British Proposals* 1929 p. 118). While discussing "standard-species" Dr. T. A. SPRAGUE (*Kew Bull.* 1926 pp. 96–100) had proposed that, in certain exceptional cases like that of *Ixia* L. (1753), it should be possible to transfer to another genus or other

genera all the original species, and to select, as the standard for the genus thus denuded, a species published subsequently to the genus and to the original species. But this exception, if admitted, would have violated the very fundamentals concerning the lectotype species, a notion thus enunciated by Dr. SPRAGUE:—

> "Obviously the generic name should not be transferred to a genus containing none of the original species" (*op. cit.* p. 96) "Rule 1—The standard species should be one which was included in the genus when the latter was first effectively published" (*op. cit.* p. 98).

Presumably in order to preserve this principle intact in the Rules, the late Dr. HITCHCOCK did not accept *Ixia* L. *Sp. Pl.* (1753) 36 et *Gen. Pl.* (1754) as typified by Dr. SPRAGUE (*op. cit.* p. 100), and proposed (*1*) first the rejection of *Ixia* L. (1753–54), and then (*2*) the conservation of *Ixia* L. *Sp. Pl.* ed. 2 (1762) 51 with *I. polystachya* L. (1762) as the standard-species.

Both the proposal of the late Dr. HITCHCOCK and the fundamental notions enunciated about standard-species by Dr. SPRAGUE in these excerpts accord fully with the notion concerning nomenclature types in Art. 18. And the strict adherence to these fundamentals would also prevent haphazard proposals being made concerning the lectotype species.

3. Conservation of Bombax is unnecessary

However, the conservation of *Bombax* sensu Miss GREEN is not only unnecessary, but it will, if thus conserved, be followed by many undesirable nomenclatural changes.

Miss GREEN says that *Bombax Ceiba* L. sensu stricto and *B. pentandrum L.* are synonymous with *Ceiba pentandra* (L) GAERTN. But all the authors so far consulted by me are unanimous in maintaining that *B. Ceiba* L. sensu stricto and *Ceiba pentandra* (L) GAERTN. (= *B. pentandrum* L) are two distinct species belonging to two different genera. [cf. DC. *Prodr.* 1824; SCHOTT et ENDL. *Metel.* 1832; ENDL. *Gen. Plant.* 1832; K. SCHUMANN in ENGL. PRANTL. *Pflanzenf.* III, 6 (1895) p. 62; *Index Kewensis;* BAKHUIZEN, *Bull. Jard. Bot. Buitenz.* VI, 1924]. Also FAWCETT and RENDLE (*Flora of Jamaica* V, 1926 p. 150) are careful to indicate that the binomial *Bombax Ceiba* cited under *Ceiba pentandra* (L) GAERTN. is not *B. Ceiba* L., thus:—

> "*B. Ceiba* Lun. Hort. Jam. I, 243 (1814) (non L)".

The two species (*B. Ceiba* L. and *B. pentandrum* L.) being different and not congeneric—none of the modern monographers having so far disputed this conclusion—there is no reason why *Bombax* L. should be rejected by legislation and *Bombax* DC should be placed among *nomina generica conservanda.* Nor is there reason to disregard the typi-

fication of *Bombax* L. (1753) by SCHOTT and ENDLICHER (1832) who reserved the name for the American element of *B. Ceiba* L. = *B. Ceiba* L. sensu stricto, and created a new generic name *Salmalia* for the Asiatic element of *B. Ceiba* L. [= *B. malabaricum* DC. (1824) = *Salmalia malabarica* (DC) SCHOTT et ENDL. (1832)].

4. The Interpretation of Bombax sensu stricto

As said above, the interpretation given to the genus *Bombax* L (1753) by SCHOTT and ENDLICHER (1832) and later by Dr. BAKHUIZEN (1924) is the correct one. It is also the one to be followed if botanists are to stabilize the names on any definite principles. The reasons given by Dr. BAKHUIZEN, though incomplete, are worthy of consideration. After pointing out that LINNAEUS had complicated the identity of *Bombax Ceiba* L. both by citing in its synonymy *Moul-elavou* of RHEEDE and by supposing that the species occurred both in the West and in the East Indies, Dr. BAKHUIZEN stated his case thus:—

> "By this error and his poor descriptions, nobody is able to make out what he meant, but after all he actually must have had in mind an American plant. Not only in the generic descriptions (Gen. Plant. 6th ed. 1764), he speaks of "calyx persistens" and moreover calls the species after an American name, *B. Ceiba*, but in the 2nd ed. of the Spec. Plant. it appears much more clearly, that he must have in mind the American plant, for he refers to JACQUIN'S description."
>
> "..... The first correction has been made by SCHOTT and ENDLICHER, who restricted the generic name *Bombax* L. to the species of American origin, and gave the name *Salmalia* SCHOTT et ENDL. to the Asiatic plants. To my opinion, they were quite right; only they failed in pointing out the principal differences between these two genera.
>
> "But the generic name *Gossampinus* HAM., which is older has priority, since *Gossampinus alba* HAM., one of the two species described under it, was removed as a synonym to *Ceiba pentandra* (L) GAERTN. so that only *Gossampinus rubra* HAM. remains in the genus." (*Bull. Jard. Bot. Buitenz. VI*, 1924, pp. 187–188).

Apparently Dr. BAKHUIZEN had not had an opportunity of consulting LINNAEUS'S *Genera Plantarum* ed. 5 (1754); for the words "calyx persistens" also occur in that edition. Besides, if the interpretation of *Bombax* is based entirely on the generic description given in *Genera Plantarum* ed. 5 (1754), it becomes impossible to take RHEEDE'S picture of *Moul-elavou*. The name *Bombax* is followed by a sign (cross or dagger) which, according to the explanation given in the introduction of the work, means that the description was derived from a dried plant (and therefore not from a living plant or from a figure). Further from the observation following the description it appears that LINNAEUS had examined more than one kind of flower

representing more than one species. This sign is, however, omitted in the *Genera Plantarum* ed. 6 (1764), whether or not by error it is not known.

But apart from these considerations, it must be remembered that SCHOTT and ENDLICHER (1832), after removing from the genus *Bombax* L (1753) *B. pentandrum* and *B. religiosum*, and so leaving only *B. Ceiba*, were the first persons to recognize the mixed nature of this species and they typified it as the American plant by transferring the Asiatic element of LINNAEUS to *Salmalia* SCHOTT et ENDL. (1832).

In further elucidation of the principles here involved I might be allowed to transcribe here some remarks I made on the subject in *Gardens' Bulletin Straits Settlements* IX (1937) :—

> "If a mixtum compositum (positive) covers two or more species or elements of a rank higher than that of species, then follow the earliest interpretation that takes into account all the *characters of greater importance* [explained in the paper], even if this interpretation does not agree with the characters of lesser importance ....." (p. 248).
>
> "Where there are equally good botanical reasons in favour of more than one specimen being chosen as the Lectotype, systematists must, in the interest of stability of nomenclature, accept as the standard of the (original) species the first published choice of lectotype" (p. 296).

Fortunately in the case of *Bombax* L (1753) it appears that the lectotype agrees with the generic description of lesser importance also, so that there is no need to go to *Bombax malabaricum* DC (1824) in order to typify it.

But now, following the recommendation by Miss GREEN, if one considers *Bombax* L. sensu strictissimo as synonymous with *Gossampinus* HAM. sensu BAKHUIZEN (1924), then one will be obliged to use another name for the genus called *Bombax* by ENDLICHER and SCHOTT (1832) and accepted as such by Dr. BAKHUIZEN (1924). Further, if the distinction made by botanists between *Bombax, Eriotheca,* and *Bombacopsis* is admitted, then the taxonomic group called *Bombax* by SCHOTT and ENDLICHER (1832), having *B. Ceiba* L. sensu stricto for its lectotype, will be without any name; and this denudation of the Linnean genus must be carried out if the generic name *Bombax* is reserved for *B. malabaricum* DC (1824). This species, however, will presently be shown to have already a very good generic name, even when it is made the type of a special genus and defined in a very restricted sense.

5. Gossampinus versus Salmalia

Both *Index Kewensis* and Dr. BAKHUIZEN give Gossam*pinus* as having been first published by HAMILTON in *Transactions of Linnean Society, London*, XV, 1827 pp.

126–128. But this is an error, for no generic name is definitely published there and HAMILTON himself refers in the *Transactions* to his previous Commentary on RUMPHIUS'S *Herbarium Amboinense*, where, he says, he gave reasons "for adopting the name affixed to it in the collection presented to the India House (*Cat. No.* 1526)". In the *Transactions* he gives therefore the synonyms which belong to the species *Gossampinus alba* which was apparently the name affixed to the specimens presented to the India House.

I have not had an opportunity to consult HAMILTON'S Commentary on *Herbarium Amboinense* (1826); but it seems obvious that the generic name referred to in that Commentary is *Gossampinus* (a name quoted also by RUMPHIUS in a note) with *G. alba* as the binomial combination under it. From the synonymy given under *G. alba* it is evident that the generic name as published in 1826 (if it is valid) has either to be typified by the Rumphian figure of *Eriophoros javana* or perhaps RHEEDE'S figure of *Panja* or *Panjala*, or to be regarded as a mixtum *compositum*. In the Commentary on RHEEDE'S *Hortus Malabaricus* (*Trans. Linn. Soc. London*. XV, 1827, p. 128) HAMILTON added a new binomial, *G. rubra*, which was based chiefly on *Moul-Elavou* of RHEEDE.

Now the first persons to recognize the mixed nature of *Gossampinus* (assuming it to be valid) were again SCHOTT and ENDLICHER (*Metel. Bot.* 1832, p. 35), who excluded the later species *G. rubra* HAM. from the genus in order to transfer *G. rubra* to another newly created genus *Salmalia* SCHOTT et ENDL. (*vide* also ENDL., *Gen. Plant.* 1840, *nos.* 5300–5303). Consequently *Gossampinus* as typified on *G. alba* became synonymous with *Ceiba* GAERTN. (a result which would follow also were the genus *Gossampinus* HAM. published in 1826 monotypic). This means that SCHOTT and ENDLICHER were the first to restrict correctly the use of *Gossampinus* to *G. alba* HAM., that is, the plant described by RUMPHIUS under *Eriophoros javana* and by RHEEDE under *Panja* or *Panjala*.

In the interest of the stability of nomenclature, therefore, botanists must accept this decision given by SCHOTT and ENDLICHER unless definite reasons are forthcoming to show that *G. alba* should not be taken as the holotype or lectotype of *Gossampinus* HAM. (1826). Until then *Salmalia* SCHOTT et ENDL. (1832) must be accepted as the correct name for the genus called *Gossampinus* by Dr. BAKHUIZEN and its type must be *Salmalia malabarica* (DC) SCHOTT et ENDL. (= *Bombax malabaricum* DC). According to the Rules the specific epithet in *B. heptaphyllum* HOUTT. (1774) cannot be legitimized under

Salmalia because the name was either a misapplication, or if not, a later homonym, of *B. heptaphyllum* L (1762).

The acceptance of this decision given by SCHOTT and ENDLICHER concerning *Salmalia* and *Gossampinus* will involve changes in the nomenclature of all the species listed by Dr. BAKHUIZEN under *Gossampinus;* but all these binomials were newly published in 1924, through the mistaken rejection of *Salmalia* SCHOTT et ENDL. and *S. malabarica* (DC) SCHOTT et ENDL. But if these changes really must be prevented (and they cannot be prevented by making *B. malabaricum* DC. (1824) the lectotype of the genus *Bombax* L.), then *Gossampinus* HAM. (if validly published) must be rejected and *Gossampinus* BAKH. (1924) must be conserved against *Salmalia* SCHOTT et ENDL. (1832) and for no other reason than botanical misunderstanding.

6. Conclusions

(i) The lectotype species (*Bombax malabaricum* DC) recommended in the Rules for the genus *Bombax* L (1753) is unacceptable; it violates the very fundamentals of the type-concept embodied in the Rules.

(ii) The genus must be typified on the American *Bombax Ceiba* L (1753) sensu stricto, the only species left in the genus out of the original three.

(iii) If *Bombax* L. is typified on the Asiatic *B. malabaricum* DC (1824) great nomenclatural changes will follow: the American plants now referred to *Bombax* L sensu strictissimo (with *B. Ceiba* L. sensu stricto as the lectotype) will be without a generic name.

(iv) *Gossampinus* HAM. as restricted by SCHOTT and ENDLICHER (1832) is merely *Ceiba* GAERTN. This sense must be accepted.

(v) *Gossampinus* HAM. quoad alteram partem is *Salmalia* SCHOTT et ENDL. (1832) which is the legitimate generic name having as its type *Salmalia malabarica* (DC) SCHOTT et ENDL. = *B. malabaricum* DC (1824).

7. Appendix

Unless it be to protect a use of a name current for a hundred years or more, it is inadvisable, I think, to add new names to the list of *nomina generica conservanda* of 1905–1910, without first establishing definite principles by which to appreciate the proposals for the conservation of names. The principle that transferred applications could be conserved has been accepted by botanists in general, but when one examines many rejections of generic names (*e.g. Oreodoxa, Conocephalus* Bl., and *Ucriana* SPRENG.) one notes that this principle is not consistently applied. Even

Dr. SPRAGUE, who otherwise strongly upholds in principle the conservation of transferred applications in order to prevent unnecessary changes (*Kew Bull.* 1926 pp. 96–100; *Brit. Prop.* 1929 pp. 47–49), rejected a proposal to conserve *Marica* in a sense used for more than 50 years previously both in revisions of that genus and in BENTH. et HOOK. f., *Gen. Plant.* (1883), ENGL. et PRANTL., *Pflanzenfam.* (1888) and DALLA TORRE et HARMS. *Gen. Siphon.* (1900), because there was an earlier *Marica* SCHREB. (1789), a superfluous name for *Cipura* AUBL. (1775) and apparently never used in that sense since *Marica* was invested with a new sense, and also because "that was an unjustifiable transference of the name of one genus to another that had been confused with it" (*Kew Bull.* 1928 pp. 278–281); and yet the last sentence in inverted commas could equally be applied to the case of *Ixia* as discussed by Dr. SPRAGUE (*Kew Bull.* 1926) or *Bombax* as discussed by Miss GREEN. Dr. SPRAGUE created a new name *Neomarica* SPRAGUE (1928) followed by fifteen new combinations under it, all of which had valid and legitimable names under *Marica*. If *Marica* HEBERT (1840) were conserved and *Marica* SCHREB. (1789) were rejected, no changes would be required in the nomenclature adopted for over three quarters of a century in revisions and many important books. The absence of a guiding principle has hitherto been a source of very erratic and disturbing proposals, one instance of which is the case of *Bombax* discussed above. *Ad hoc* decision by votes is not a satisfactory procedure in science, as it introduces an element of resentful diversity. Besides, voting on such matters may be swayed by the personalities of either the proposers and the seconders or the opposers, a thing not so easy to happen if there are some principles by which to appreciate such proposals. If the proposals for the conservation and rejection of names were put for the approval of specialists in each family or genus, the case might be different, for they would be in the position of appreciating the proposals in their correct perspective; but since that is not possible, I still believe that in such matters as the recognition of *nomina generica conservanda aut rejicienda*, "general laws are much better for the guidance of botanists than obligations to call now and then upon the Executive Committee to give its arbitrary decisions." (*Gard. Bull. Straits Settl.* IX, 1937 p. 253).

NOTE.—Since writing the above I have discovered that LINNAEUS himself was the first person to exclude RHEEDE'S *Moul-elavou* from *B. Ceiba; see* LINN., Syst. Nat. ed. XII (1767) 457.

A NEW MAPANIA (CYPERACEAE) FROM THE MALAY PENINSULA

By H. Uittien

Mapania tumida Uitt. nov. spec.

E subgenere *Pandanoscirpi, Mapaniae enodi* (Miq.) Clarke proxima, sed foliis caudatis, scapis apice tumidis, primo visu diversa.

Rhizoma crassum, 1 cm. diametro. Folia coriacea glaucescentia 1.35 m. longa vel ultra, 2.5 cm. lata, tertia parte basali complicata, ceterum flaccida, margine remote et grosse dentata vel lævia, subtus præsertim basi reticulato-nodulosa et pallidiora, apice subito in caudam triquetram asperrimam contracta.

Scapi efoliati, 14–22 cm. longi, basi squamis nonnullis ovatis vel oblongis obtusis papyraceis, spatio fere 4 cm. longo, absconditi, basi 1–2 mm., apice 3 mm. crassi, læves. Spicula fructifera conica, 2 cm. longa, 1.5 cm. lata. Flores ignoti. Nuces ut in *M. enode* (Miq.) Clarke (*M. longa* Ridl.), 5 mm. longæ, depresse globosæ, manifere apiculatæ, rugosæ, basi constrictæ et in stipitem 2–3 mm. latum, angulosum dilatatæ.

Peninsula malaica, in ditione Johore, Sungai Kayu, S. Sedili, in silva paludosa. Legit E. J. H. Corner, d.d. 3 Aug. 1935, S. F. nr. 29736.

Typus in herbario bogoriense (Buitenzorg); Typi duplum in herb. Singapore.

Botanical Museum & Herbarium,
State University, Utrecht (Holland).

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1. **The Agricultural Bulletin of the Malay Peninsula** [Old Series] nos. 1–9, 1891–1900 (out of print).

2. **The Agricultural Bulletin of the Straits and F.M.S.** [Second Series, monthly issues] Vols. 1–10, 1901–1911. Most numbers are available, price 50 cents each or $5 per volume.

3. **The Gardens Bulletin, Straits Settlements.**

   Vol. 1 nos. 1–5, January to May 1912 (as *Agricultural Bulletin of the Straits and F.M.S., Third Series*). nos. 6–12, December 1913—March 1917 (as *The Gardens Bulletin, S.S.*).

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   Vol. 4 nos. 1–12, June 1926—January 1929.

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